COAL AGE

With which is consolidated "The Colliery Engineer" and "Mines and Minerals"
Published by McGraw-Hill Publishing Company, Inc.
H. W. CLARKE, Vice-President

JULY 1938

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Volume 43 No. 7

Underground at Isabella: see page 57

● **"Good wine,"** remarked the late Mr. Shakespeare, "needs no bush"—especially with the product sparkling before you. But credit should be given the makers. The Isabella stories in this issue all were written by Ivan Given, associate editor; their preparation was made possible by the wholehearted cooperation of R. S. Walker, S. M. Cassidy and their Weirton associates. Turn to page 49 and read on.

● **Pitching beds** 50 ft. thick have their drawbacks. Run out by sliding coal, you can go back through the rock and try again. That way didn't satisfy Lehigh Navigation, which has developed a system for extracting blocks of anthracite 40x90 ft. or less in four sections. The story of this system with its greater safety and better recovery is scheduled for August Coal Age.

● **Safety** captures the headlines several times in this issue. Accident-prevention work at the Isabella mine is detailed in the feature article on page 77. Promotion of safer operation naturally dominated the annual Mine Inspectors' convention reported on page 94. This same theme was a headline topic at the summer meetings of the Illinois and Indiana institutes, covered on pages 116 and 108.

● **Starting** experimental work with conveyors late in 1935, Red Parrot mine at Prenter has steadily improved methods and stepped up production efficiency. Today, under favorable conditions, an average of 15 tons per man-shift is attained. How mining methods and equipment have been modified to capitalize on experience and to meet changing conditions will be related in a step-by-step story next month.

● **Rocky Mountain** mining men are gathered at Denver for their annual interchange of operating experience as this issue of Coal Age goes to press. And Ivan Given is perched on a front-row seat, pencil in hand, to take notes of what goes on. His story of the high spots of the pow-wow will be translated into type for the news section of our August issue.

● **Something new** in fire fighting was demonstrated in combating an underground conflagration which recently menaced Scranton and near-by mines. Ducts took in air and drew it out on both sides of the fire so that no air passed over it. Thus, bare-faced men could drench the fire, which was extinguished in a few days without accident. P. H. Dever tells how on page 112.

COAL AGE is published monthly on the 1st. $3 per year in the United States, Canada, Mexico, Central and South America; other countries, $5, or 20 shillings. Single copies, 35 cents each. Entered as second-class matter Oct. 14, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in the U.S.A. Cable address: "McGrawhill, N. Y." Member A.B.P. Member A.B.C.

McGRAW-HILL PUBLISHING COMPANY, INC.
JAMES H. McGRAW, Founder and Honorary Chairman
Publication Office, 99-129 North Broadway, Albany, N. Y.
Editorial and Executive Offices, 330 West 42d St., New York, N. Y.

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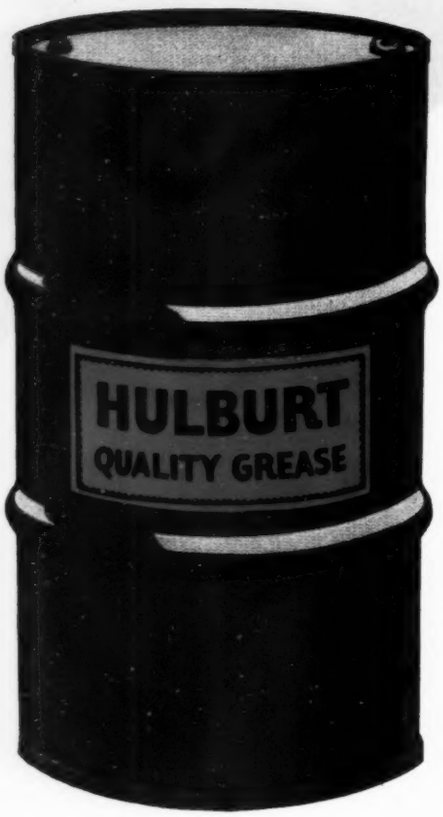
STOP
and think



Before you buy *any* greases not made especially for coal mine lubrication, stop and think what the wrong type of grease can cost you in shut downs, replacements and power losses. Think what a small expense correct lubrication is, compared to the value of your equipment and the cost of its operation . . . Stop and consider that Hulburt Quality Grease is standard in 26 out of 30 of America's largest coal mines!

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COAL AGE

Established 1911—McGraw-Hill Publishing Company, Inc.

DEVOTED TO THE OPERATING, TECHNICAL AND BUSINESS PROBLEMS OF THE COAL-MINING INDUSTRY

SYDNEY A. HALE, *Editor*

July 1938

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Wanted: A Cure

NOT FOR LONG perhaps will mining and other industries be able to withstand the urgency of the disciples of Izaak Walton to whom cost of water purification is no object. A bill establishing a Division of Water-Pollution Control in the U. S. Public Health Service has passed Congress and now awaits Presidential ratification. The new division is authorized to prepare plans with State and municipal agencies for eliminating or reducing stream pollution and to give grants-in-aid or loans for constructing treatment works. Though without powers of enforcement, establishment of the division is a challenge to all industries to ascertain what, if anything, can be done to reduce inexpensively the nuisances they admittedly are creating.

Coal operators, for example, can remove fines from the effluents of their washers. If the cost of drying the sludge is too much, bituminous operators—in some cases at least—can separate the fine coal before washing and mix it with the washed product or dispose of it where it will not wash into the streams or become oxidized so as to acidify them. Mine waters perhaps either can be sealed with safety or passed rapidly from mine face to stream and not allowed to back up on already oxidized pyrite.

Possibly the pyrite in sump areas can be protected from oxidation by paint, rock dust, whitewash or gunite. That in adjacent areas, being kept free from water for long periods of time, may become so completely oxidized that it will not dissolve in fresh water and thus will do little harm should a freshet submerge an area otherwise kept dry. Whether these means will be effective or whether others will be devised remains in part to be proved, but some of them at least will tend to clarify the effluent and reduce acidification.

Under the new federal law, it will be the duty of the appointed government officials to aid in determining a practical cure, or to admit that for any given industry no such remedy exists. No longer will the reformers be able to demand a cure without being required to define what the specific should be. Some day the public will have to decide definitely what clarity tolerances can, with reason, be allowed. In such matters it must be remembered that the public, like the consumer, must always be right.

Costs vs. Prices

UTAH OPERATORS, members of District Board No. 20 set up under the Guffey act, have protested to the National Bituminous Coal Commission against the inclusion of captive-mine tonnage in cost determinations used in minimum-price fixing. Such inclusion, it is contended, will unduly depress the weighted average costs and "result in inequity to commercial producers." Inclusion of captive-mine costs in Montana, it was testified at the Denver hearings last month, would result in a weighted average 68 cents per ton less than the cost of production for commercial operations in that State.

The position taken by the Rocky Mountain protestants is one deserving sympa-

thetic consideration. It also raises another question apparently ignored in the earlier price-fixing activities of the Commission. If it is unfair to high-cost mines to unduly depress prices through unsound averaging of the costs of dissimilar groups of operations, is it fair either to the low-cost mines or the consuming public to unduly raise minimum prices to make such low-cost producers carry the burden of their high-cost competition?

Certainly, the dissimilarity between the mechanized and the hand-loading commercial mine is as broad and as sharp as that between the commercial and the captive operation. In the battle of competitive fuels, mechanization offers the coal operator his one opportunity to meet his rivals on the field of price without undermining wage rates. To the extent that the mechanized producer can succeed in this bitter conflict, the coal industry, as well as the individual producer, benefits. Why hamstring this group with prices designed to protect mines which cannot hope to meet the onslaughts of competitive fuels until such mines also mechanize?

Will-to-Safety

Modern factory conditions usually are unfavorable to starting an electrical fire. The walls generally, being constructed of concrete or brick, are relatively dry. In the mines, timber and coal—both often wet—are the most general environing and supporting materials, yet the electrical wiring underground frequently is far inferior to that found in factories; this rarely because companies are unwilling to pay for a good electrical job but because the work is not closely supervised and the men who do the work have not been informed as to the manner in which it should be done.

With the large currents now carried in a single conductor more explicit directions and closer supervision than often given is necessary. A safe job frequently requires expertness and a will-to-safety rather than excessive expenditure, and these are obtainable where men are trained to perform their work in a proper manner. On the whole, the electrical mechanic around a mine is as responsive as any to advice, instruction and regulation, perhaps because he often has no long backlog of practice to make him doggedly determined to perform his task in his own way.

King Coal's Ally

Modern equipment is playing a dual rôle in the rehabilitation of the coal industry. On the production side, it is reducing costs; on the utilization side, it is holding old markets and promises to regain much tonnage once written off as lost. The achievements of the small stoker in the domestic market have built new standards and given substance to revived hopes. Although less highly publicized, noteworthy gains also have been made in the industrial and allied fields.

Most recent and most dramatic is the fact that the new streamlined trains which started their runs between Chicago and New York on June 15 over the New York Central and Pennsylvania rails are coal burners. No longer can it be said that diesels and electrics are the last word in fast railroad transportation. The coal-burning "Mercury" put into service between Cleveland and Detroit a few years ago challenged that assumption; the "Broadway" and "Twentieth Century" challenge it still more loudly.

Less spectacular but none the less significant is a late report on commercial and industrial installations of combustion equipment in Chicago. This shows that in April the city smoke department issued 34 permits for commercial and industrial underfeed stokers, two for spreader-type stokers, nine for hand-fired equipment and only six for oil burners and two for gas burners. These figures are exclusive of small-home and two-flat-building installations for which no permits are required. King Coal and modern equipment at the mine or in the consumer's plant make a powerful combination.

Isabella surface plant and town lie along the northern bank of the Monongahela River

COST AND QUALITY

+ National Steel Corporation Goals

In Modernizing Isabella Mine

MODERNIZATION and mechanization work initiated last year at the Isabella (Pa.) mine of the Weirton Coal Co. places it in the top rank of operations in which completely mechanized multiple-shift loading and auxiliary operations underground are complemented by completely mechanized preparation and refuse disposal on the surface for the dual purpose of cost reduction and improvement in coal quality.

The Weirton Coal Co. is a division of the National Steel Corporation, and Isabella mine supplies metallurgical coal from the Pittsburgh seam to the byproduct ovens of the Weirton Steel Co., at Weirton, W. Va. T. E. Millsop is president of both the Weirton Steel Co. and the Weirton Coal Co. J. S. Williamson is general superintendent of the Weirton Steel Co., with both steel and coal operations under his jurisdiction.

The M. A. Hanna Co., which is closely associated with the National Steel Corporation, had had considerable experience in the mechanization of coal mines and the construction of washeries through its subsidiaries, the Hanna Coal Co. and the Susquehanna Collieries Co., as well as through its association with the Union Collieries Co., and consequently when it was decided by the National Steel Corporation to investigate the possibilities and economics of carrying out a similar program at the Isabella mine, the Hanna organization was asked to undertake the investigation.

Coal Study Made

Examination of, and preparation of a report on, the property were undertaken by R. S. Walker, consulting engineer for the M. A. Hanna Co. This embodied, among other steps, the necessary coal sampling and the conduct of float-and-sink tests to determine the washability characteristics of the coal. This work was carried out under the direction of C. W. Lotz, assistant consulting engineer, who later was responsible for the design and construction of the washery.

Necessary equipment for one complete mechanical-mining unit was purchased so that experience could be gained for the determination of mining methods and cost data. At this time, S. M. Cassidy, with an excellent background in mechanical mining, was appointed manager of the Weirton Coal Co., and the underground experimental work was carried out under his supervision. The mining system finally adopted and the operating practices now in effect are the fruits of his efforts.

Upon completion of the investigation, a report was prepared jointly by Messrs. Walker, Cassidy and Lotz, and the expected results set forth therein satisfied the executives of the corporation that the project should be undertaken. Early in February, 1937, Mr. Walker was authorized to proceed with the work and was given full responsibility for carrying out the entire program.

Objectives of the Isabella modernization and mechanization program can perhaps be best stated by quoting from the letter of transmittal ac-

companying the engineering report on which the program was based. In this letter, dated Jan. 25, 1937, these objectives were listed as follows:

"1. Means of controlling the ash analysis of the coal shipped from the property by the construction of a cleaning plant to obtain the lowest economical ash and sulphur content, and particularly uniformity of the product.

"2. Mechanization of the underground operations with a view to reducing mining costs.

"3. Improvements in transportation and refuse disposal as a means of increasing efficiency and lowering costs in these departments."

Broad Program Adopted

How the above and other supplementary objectives were attained is the subject of the following six articles in this issue of *Coal Age*, but in brief they were based on construction of a complete blending, washing and dewatering plant for mechanically cleaning and otherwise preparing the entire mine output; installation of a 3,350-ft. aerial tramway for refuse disposal; rebuilding the harbor and barge-loading station; discarding hand loading, shortwall cutting and horse gathering haulage in favor of track-mounted mobile loaders, track-mounted cutting and shearing machines and motorized gathering with specially designed explosion-tested locomotives; adoption of a new mining system; installation of a slope belt for coal and slate; reconstruction of the bottom and main-line and secondary haulage roads, including guniting and the elimination of timber legs; purchase of 182 10-ton all-steel mine cars; complete revision and extension of underground power-distribution facilities, including changing d.c. voltage from 550 to 250 and installation of three portable Ignitron substations; installation of a complete new underground shop and adoption of systematic maintenance and repair methods; inauguration of an educational program and improvement of physical conditions to reduce injuries; and adoption of a thoroughgoing program of company-town improvements.

As a result of these improvements, Isabella becomes the first completely mechanized mine in the Connellsville coking-coal region of western Pennsylvania. It also is the first mine to adopt a 10-ton car; the first to completely equip with Ignitron a.c.-d.c. conversion units; and the first to use portable units of this type. The preparation plant also is believed to be the first to be so completely equipped with automatic weighing and sampling equipment for complete determination of raw-coal, washed-coal and refuse weights and for automatically sampling the same products for preparation control and analysis. The Isabella washery is the fifth preparation plant constructed at mines of the M. A. Hanna Co.'s associates or subsidiaries using the Link-Belt Simon-Carves washing system, the first installation having been made by the Link-Belt Co. in 1929.

Isabella mine, which, as noted above, recovers the Pittsburgh seam, is located in Fayette County, Pennsylvania, in that part of the Connellsville district known as the Klondike basin. The property (see Fig. 1, p. 52) borders on the north bank of the Monongahela River at a point eight miles south of Brownsville and fifteen miles west of Uniontown, Pa. Present workings are on the western side of the Brownsville antieline, and eventually mining will extend down into and across the neighboring syncline to a point near the outcrop to the west.

Isabella Mine Staff

In addition to the general officers named in the accompanying article, Isabella mine is staffed by the following operating, electrical and maintenance men:

Thomas Park, superintendent, general supervision of mine and surface operations.

George Rigg, mining engineer, who assisted in the development of the mining plan instituted with the change to mechanical loading.

C. J. MacDonald, electrical engineer, responsible for the electrification work and for the maintenance and repair systems now used at Isabella.

G. N. McLellan, safety engineer, responsible for the Isabella safety program.

John Bradburn, general mine foreman, supervision of underground operations.

W. D. Heller, master mechanic and outside foreman, supervision of surface operation and maintenance and repair of surface equipment.

George Kemp, chief electrician, supervision of maintenance and repair of underground power-distribution systems and electrical and mining equipment.

The mine was opened by shafts sunk by the Kuhn interests in 1909 and was named for Mrs. Isabella Kuhn. Initial equipment included air-driven breast machines and horses for gathering. Production was small and later the operation passed through a number of hands until it was acquired in 1916 by the Hillman interests, which operated it under the Hecla Coal & Coke Co. name. Output was boosted considerably by the Hillman organization, which installed a 550-volt d.c. distribution system to serve permissible shortwall cutters and main-line locomotives. Horses, however, were retained for gathering, while the compressed-air lines were removed and, consequent to a change to purchased power, the boiler plant supplying steam for the hoists was dismantled.

In the Hillman period of operation, two tipples were in service—one for rail and river shipments and the other supplying coal to a battery of coke ovens, from which a trestle ran to the river to permit barge shipments of coke. The tipples were furnished with coal by two hoists in separate shafts. Output from the two shafts at one time averaged as much as 7,000 tons per day. In 1927, a slope for men, horses and supplies was sunk by Hillman. The slope now is the main coal opening, and in addition to providing passage for men and materials is fitted with a belt conveyor.

Weirton Buys Mine in 1929

The Isabella property was purchased by Weirton, which had previously operated the Redstone Coal & Coke Co. mine near by, in 1929.

Although facilities for making rail shipments are available on the Monongahela R.R. in case of emergency, Isabella coal normally is shipped in barges down the Monongahela and Ohio rivers to the Weirton Steel Co. byproduct coke plant at Weirton, W. Va. For this purpose Weirton Steel owns 42 steel barges having an average capacity of 875 tons each and drawing 8 ft. of water when loaded. Towing is done by contract.

The Weirton coking plant consists of three batteries of Koppers Becker-type ovens. No. 1 battery, 37 ovens, was installed in 1923; No. 2, 49 ovens, in 1926; and No. 3, 25 ovens, in 1930. Each oven has a capacity of 14.2 tons of coal. In addition to the ovens, the coke plant also includes byproduct and benzol divisions for recovering tar, ammonium sulphate and benzol products.

MINING METHODS AND MECHANICAL LOADING

+ At Isabella Mine

AS A RESULT of a modernization campaign carried out in 1937, the Isabella mine of the Weirton Coal Co. now takes its place in the top rank of mechanized multiple-shift operations employing the latest type of equipment for cutting, drilling, loading and gathering and also becomes the first completely mechanized mine in the Connellsville coking-coal region of Pennsylvania. Following several months of operation with one experimental mechanized unit to gain certain information on best practice, the new system was inaugurated in November last year. Since that time a steady improvement in performance has been noted, indicating that the unit production standards set up when the system was laid out probably will be exceeded by the end of 1938.

The Isabella property was opened by shafts sunk in 1909 and operations originally were based on the use of air-driven breast machines and horse haulage. After passing through several hands, the property was acquired by the Hillman interests in 1916 and was operated as the Heela Coal & Coke Co. Under the Hillman management, 550-volt permissible shortwall cutters were installed, along with electric-locomotive haulage on the main lines. In 1929, the property was purchased by the Weirton Coal Co., which subsequently installed 250-volt permissible electric coal drills, operated with a resistance on fresh air, inasmuch as 550-volt models were not allowed.

From the equipment standpoint, this was the picture at the time modernization was decided upon. Working methods were based on the standard Connellsville region block system with 12- to 14-ft.-wide rooms, entries and crosscuts to divide the coal into square blocks on 100-ft. centers, which were then recovered at Isabella by the pocket-and-stump method.

With the adoption of mechanization, hand loading was replaced by track-mounted mobile-loading machines, while cutting is now performed by late-type hydraulically controlled track-mounted cutting-and-shearing machines. The hand-held drills previously used were retained pending further investigation as to the correct type for the future, since they were of a type that would work in with the new system, and 55 horses for gathering were displaced by improved-type specially designed 8-ton gathering locomotives of the explosion-proof type. To permit the equipment to work with maximum efficiency, an angle system of driving rooms and crosscuts was

Loading machine starting a cut-through in a pillar at Isabella.

adopted under which all working places and the necessary crosscuts are turned 60 deg., leaving diamond-shaped pillars. (The management is inclined to the opinion that 45-deg. angles might prove even more satisfactory than 60-deg. in virgin coal not cut up by 90-deg. development.) These pillars are recovered by driving cut-throughs across the end next to the gob, leaving a thin fender between the pillar place and the caved area. As discussed in other articles in this issue, improvements in face equipment were accompanied by changes and extensions in d.c. power equipment and distribution, trackage, mine-car equipment, etc., all with the idea of keeping the loading machines actually at work in coal as much of the time as possible.

Face equipment at the mine now consists of eight shoveling-type track-mounted coal-loading machines, eight hydraulically controlled cutting and shearing machines, ten 8-ton gathering and swing locomotives designed especially for use behind loading machines and eleven hand-held coal drills, most of which already were in service. All of the above equipment is of the "permissible" type except the locomotives, which are "explosion-tested." In addition, a total of 182 10-ton mine cars, the first of that size ever installed in a coal mine in the United States, were placed in service to reduce car-changing time.

The operating schedule finally settled upon is based on working six mechanized-mining units two turns every working day with an interval of 4½ hours between the first and second loading turns, and also with the loading and preparation shifts staggered three hours so that plenty of working places are available at the start of either the loading or preparation turns. Under the Isabella plan, a mechanized unit comprises one loading machine, one cutting machine, one drill and one gathering locomotive, in addition to the necessary auxiliary equipment, such as push trucks for all track and timbering crews, etc. To facilitate maintenance and eliminate as much as possible time losses growing out of major breakdowns, the above equipment list provides two spare cutters, two loaders and two cable-reel locomotives. This makes it possible to have at least one completely overhauled machine of each type standing by ready for service at all times while the second is available for proper shop servicing with no necessity for rushing the latter work and thereby possibly skimping some of it.

Average thickness of the Pittsburgh seam mined is 7½ ft., of which not less than 8 nor more than 12 in. is left in place in the top to hold up the drawslate, which runs fairly uniformly 12 in. thick. Over the drawslate is 0 to 5 or 6 in. of Pittsburgh "rider" coal, followed by an average of 3 ft. of "checker" slate, over which is sandstone. Beneath the seam is about 24 in. of fireclay (see typical section, Fig. 1, p. 64). Average thickness of the cover is 400 to 450 ft., with the maximum as 650 ft. Little trouble usually is encountered in breaking the cover as each cut is taken off a pillar. Aside from the ever-present problem of holding up the drawslate, the most troublesome natural condition is the great number of "horsebacks," or bottom rolls, occurring throughout the mine. These are very hard and flinty in nature. Normally the horsebacks are not over 30 in. high but sometimes they extend 5 or 6 ft. up from the floor.

For all practical purposes, Isabella mine was converted from the old to the new basis almost from one day to the next, although a number of men were rotated for a short while each, in turn, on the experimental mechanization unit noted above. In making the conversion, previous employees were assigned, as far as could be determined, to tasks to which it was thought they would be best suited, either from the standpoint of experience or temperament, with the idea that shifts would be made as required. With this as the basis, the new system went into effect with the men learning as they worked. Results have been satisfactory, and the seasoning process is proceeding on or better than schedule. In mining, the human element, both men and bosses, plays a larger part than in most industries and one of the main jobs at Isabella has been, and still is, education in the new work.

Another major condition which has influenced both working methods and performance is the fact that loading machines necessarily were started in territories which had been developed several years ago, thus presenting the problem of adjusting best-suited mining plans to existing conditions. In fact, under the contemplated working schedule, it will be about four years or more before virgin territory to the west of the present

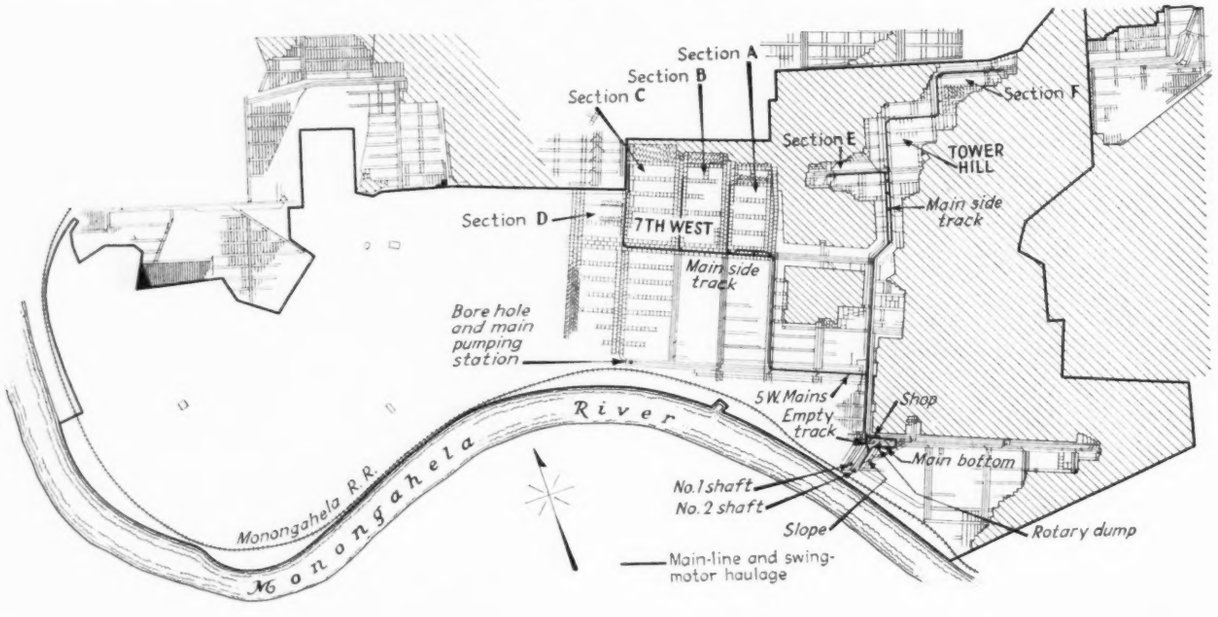


Fig. 1—Isabella mine workings, showing present working sections and main and secondary haulage routes.

working sections (Fig. 1) can be tackled and development and mining operations carried on without the handicaps enumerated just above, and eight to ten years before all of the old development is worked out.

As indicated in Fig. 1, two of the mechanical-loading units operate in what is known as the Tower Hill section of the mine, with the other four in the Seventh West Mains territory. The Tower Hill units are engaged in completing recovery of the coal between the two old gobs shown, working back toward the main-haulage junction at Fifth West Mains. The Seventh West units are working roughly south to the Fifth West Mains to complete recovery of the coal in this previously developed territory, whereupon extension of the Fifth West entries to the western end of the coal acreage will be started to permit the inauguration of operations in the virgin-coal reserve.

Caving of the old development openings is general and is much more pronounced in the case of the face entries, driven, as indicated, slightly northeast. In many cases, falls of 30 to 50 ft. are encountered, while practically all places are fallen in 2 to 4 ft. While caving of the butt entries was not quite so bad, they still presented a choice between a heavy clean-up expense or the driving of auxiliary openings in solid coal. The choice was the latter, as indicated in Figs. 2 and 3. In fact, particular pains are taken to avoid even crossing an old opening where avoidable, due to the clean-up expense which this entails, and this consideration affects all projections.

Monkey Butts Necessary

As noted above and shown in Figs. 2 and 3, old butt headings are being paralleled by new openings termed "monkey butts." In addition, as shown in Fig. 3, new openings paralleling the face headings also are necessary at times. Depending upon conditions, old butt headings may be paralleled by a single new opening, leaving a pillar just sufficiently thick for one cut-through and two side fenders for the subsequent retreat work. Crosscuts at intervals into the old heading provide for air return while driving the opening, with the monkey butt, of course, serving as the intake. Incidentally, two-door airlocks are required by law on each butt-entry intake, with additional doors on the butt, to maintain a continuous current to the working places and to sweep the gobs in rib work.

Places are top cut and sheared with track-mounted machines fitted with water tanks to supply sprays on the cutter bars. This view also shows a typical timbering job.

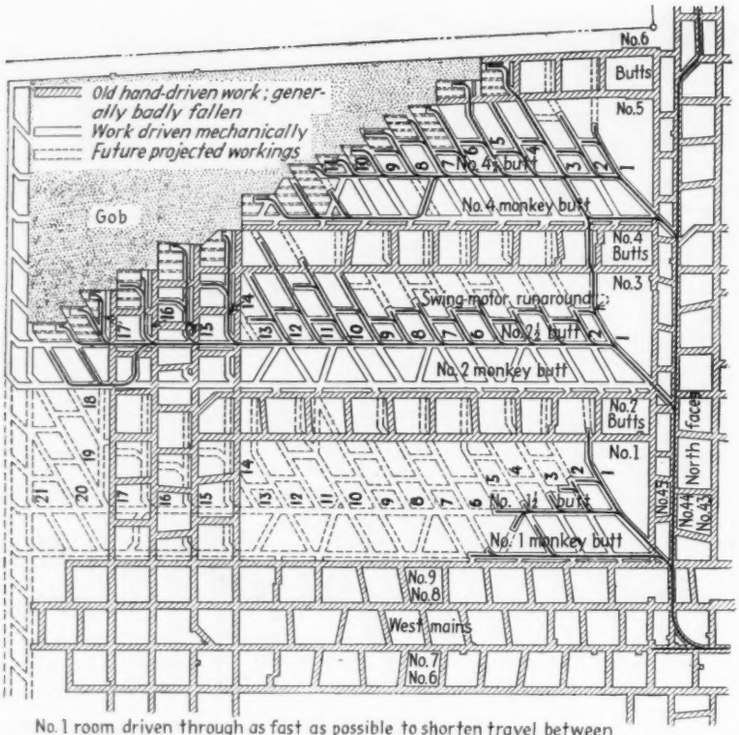
Headings and crosscuts are driven 12 ft. wide. Centers, in the case of butt entries, or rather monkey butts, where two are driven, are 114 ft., measured on the 60-deg. line, which allows four cut-throughs with necessary fenders for the rib work to follow. Room and room-crosscut width is 14 ft. Room centers are 72 ft., measured on the butt, and crosscut centers are adjusted in general to provide either three or four cut-throughs. This leaves the coal in general in diamond-shaped blocks approximately 72x90 to 110 ft. in size. As the monkey butts are advanced, the rooms are driven far enough to permit connecting the first crosscuts, whereupon they are allowed to stand until mining advances to the point where it is necessary to start driving them up to meet the advancing pillar line. This also permits the trolley wire to be advanced up the butt on fresh, intake air. There is, however, one exception to this rule, in that one room generally is driven through as fast as possible, as indicated in Fig. 3, to shorten machine travel from one butt entry to the other and to afford a run-around so that the swing, man-trip and supply locomotives can get on the proper end of the trips.

Each mechanical-loading unit, under the Isabella system, takes care of its own development in addition to mining rooms and pillars. Generally, the relation between pillar work and solid work is about 75-25. All openings, as far as possible, are driven on 60-deg. angles, making it possible to do a better job of cutting and loading and also facilitating transportation and equipment travel. Pillar, or "rib," lines, as indicated in Figs. 2 and 3, are continuous in any one mechanized section, particularly in the Seventh West territory. In Tower Hill they are not always continuous, due to the prevailing cut-up conditions. Driving of rooms, as pointed out above, is adjusted so that at any particular pillar-line position the rooms meet it slightly in advance, allowing enough time to clean up the slate across the old works, connect the track and place the necessary timbering.

Three Pillar Angles Used

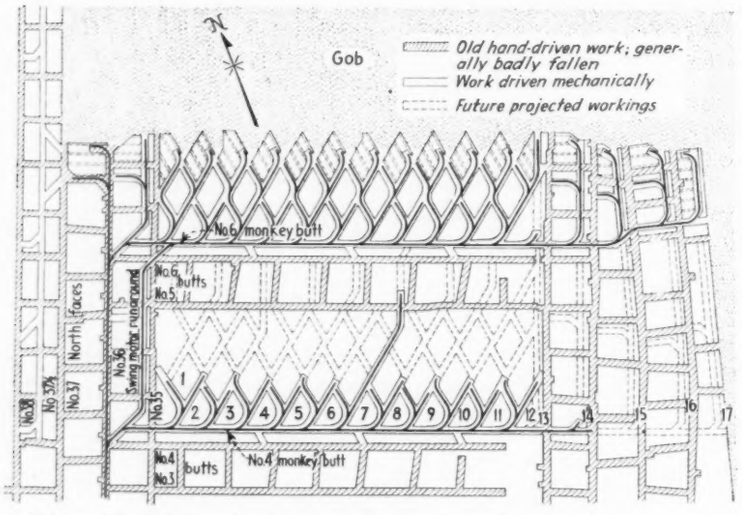
To date, pillar lines have been established on three different angles with relation to the face cleats. In the Tower Hill section, the line in general is on an angle of about 45 deg., whereas in the "D" section in Seventh West the angle is about 30 deg. Observations to date indicate possibly slightly better roof action at either of these limits or between them. However, a "square" rib line parallel with the face cleats is in operation on the remaining three sections (*A*, *B* and *C*, Fig. 1) with very good results so far.

Method of mining a diamond-shaped room pillar in a 30-deg. pillar-line section is detailed in Fig. 4. Identically the same system is followed in the case of square pillar lines, except that the pillar



No. 1 room driven through as fast as possible to shorten travel between butts, and to provide swing-motor runaround. Same applies to No. 9 and No. 10 rooms

Fig. 2—Working section in Isabella mine, showing typical 30-deg. rib line, method of driving "monkey butts," and track layout.



No.7 room to be driven through as fast as possible to shorten travel between butts

Fig. 3—Working section showing typical "square" rib line.

points are not stepped. As shown in the figure, the pillar is removed in 21-ft. lifts, each lift consisting of an 18-ft.-wide cut-through driven across the end and separated from the gob by a 3-ft. fender made up of a series of stumps, inasmuch as the fender is cut clear through at intervals. Leaving the fender has been found an excellent method of holding up the top coal and draw-slate, reducing materially the quantity of timber which must be used, as well as any tendency of the gob to slide in on the men. When the cut-through is completed, the fender stumps are shot, if necessary, and allowed to crush down in the gob. Protection in driving the cut-through is provided by steel-rail crossbars set on 6-in. timber posts, as indicated in Fig. 4.

Specific standards have been set up for this operation, as well as all other face operations in the mine, and foremen and employees have been provided with the necessary blueprints for guiding them in their work. In driving openings and turning crosscuts, for example, strict adherence to standards is necessary to facilitate loading and cutting and also so that track can be laid in the proper position to provide the necessary clearance and the smoothest possible transportation. Likewise, standards have been set up for other face operations, such as cutting, drilling, etc. Establishment of these standards and distribution of prints was a decided advantage in starting from scratch with green supervisors and men, and has proved one of the quickest and best methods of educating them in the proper methods of performing their various tasks. Naturally, with standards made in advance for the pioneer attempt at complete mechanization in the Connellsville district, some changes subsequently were found desirable.

Working Shifts Overlap

While the face-preparation and loading shifts overlap under the Isabella system, no face preparation, as a rule, is carried on for loading machines working during part of the same preparation shift, as the face-preparation men normally are engaged in preparing only for the succeeding shift. Loading shifts run from 7 a.m. to 2:30 p.m., and from 7 p.m. to 2:30 a.m. Face-preparation shifts, on the other hand, run from 10 a.m. to 5:30 p.m., preparing for the 7 p.m. to 2:30 a.m. loading shift, and from 10 p.m. to 5:30 a.m., preparing for the 7 a.m. to 2:30 p.m. loading shift. Two shifts a day, it has been found, result in a minimum of lost time, as compared with having both face preparation and loading going on at the same time, as would be the case with three shifts, with consequent interference. And, in addition, sufficient time is available for a reasonably thorough job of inspection, maintenance and lubrication of the loading and cutting machines. Staggering preparation and loading shifts also insures that loading equipment, for example, is out of the way of subsequent operating units by the time they are ready to start to work, and vice versa.

Two-shift operation, furthermore, permits giving better attention to the problem of horsebacks, which to date are handled by first loading off the coal as far as possible and then drilling them with pneumatic drills

prior to shooting them up for loading. In addition, a better opportunity is provided for making falls, a very necessary feature when extracting pillars. The latter is done by special fall crews under a separate boss, usually with a steel rope about 100 ft. long with the necessary number of attached chains or short ropes for pulling out the crossbar and both posts. Pulling is done with a gathering locomotive, and when operating two shifts there is a period of about three or four hours during which working locomotives are used, with the spare locomotives available for the rest of the shift. A material increase in timber recovery, particularly crossbars, and a better condition of the pillar line as a result of making the falls when required and in the proper manner, have been the major results of the separate fall-crew system.

Upon completion of loading in a place, the timbermen come in and set two crossbars on 4-ft. centers, or one-half the usual depth of cut. Crossbars are cut from 60-lb. used rail, as a rule, but experiments with 4x10-in. sawed-wood crossbars are now under way. Crossbar lengths have been practically standardized at 14 and 18 ft. in rooms and rib places and 13 ft. in headings. In headings, as far as possible, and also in room and rib places, the practice is to cut over on one side to make a hitch in which one end of the bar is placed, using a post under the other. Three timbermen are necessary on a crew to handle the heavy crossbars and they are supplied with special timbering jacks and push trucks. Both wedge and straight caps are used and are bought ready sawed in all cases. In no case is the last crossbar in a place supposed to be more than 8 ft. from the face before it is cut, and with the type of cutting equipment in use it is possible to top cut, leaving a normal ledge, with the crossbars as close as 5 ft. from the face. Normal timbering for good roof support in rooms and rib places is shown in Fig. 4.

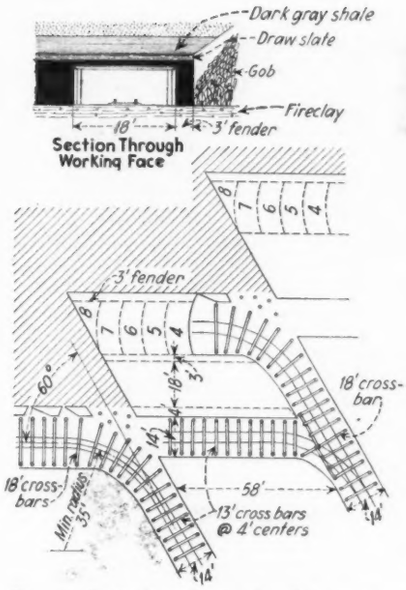


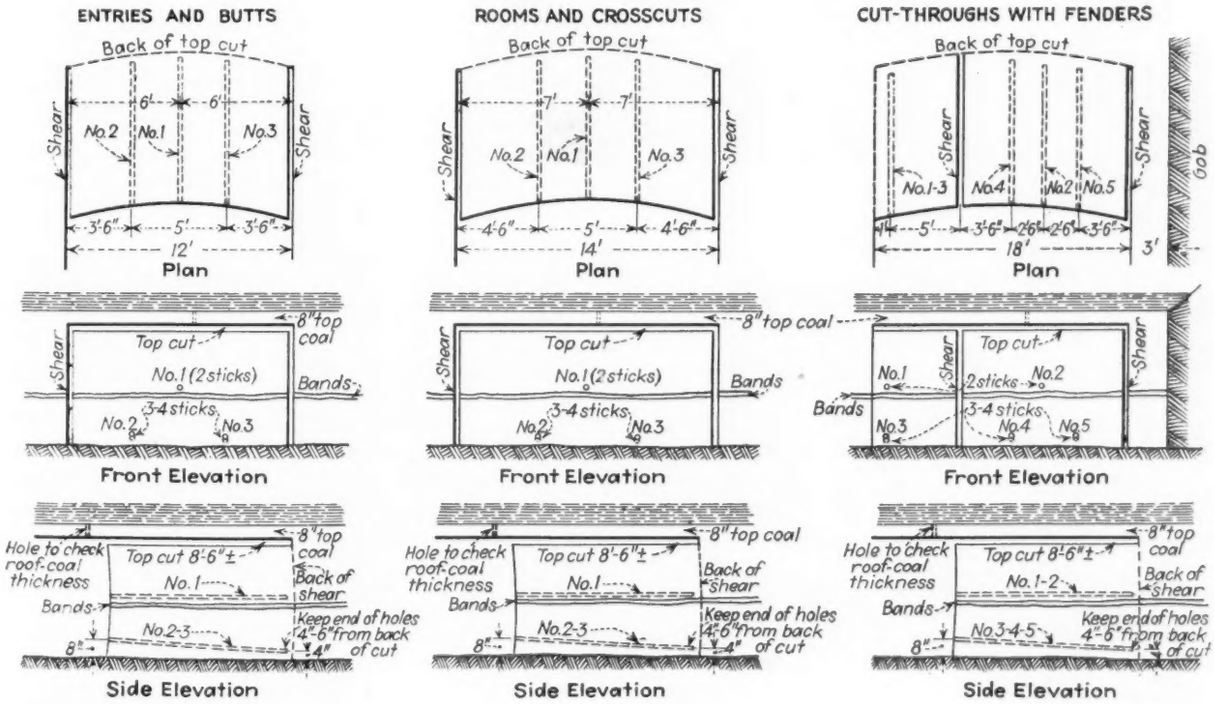
Fig. 4—Typical method of pillar extraction on a 30-deg. rib line, showing cut-throughs and fenders, as well as the usual timbering system.

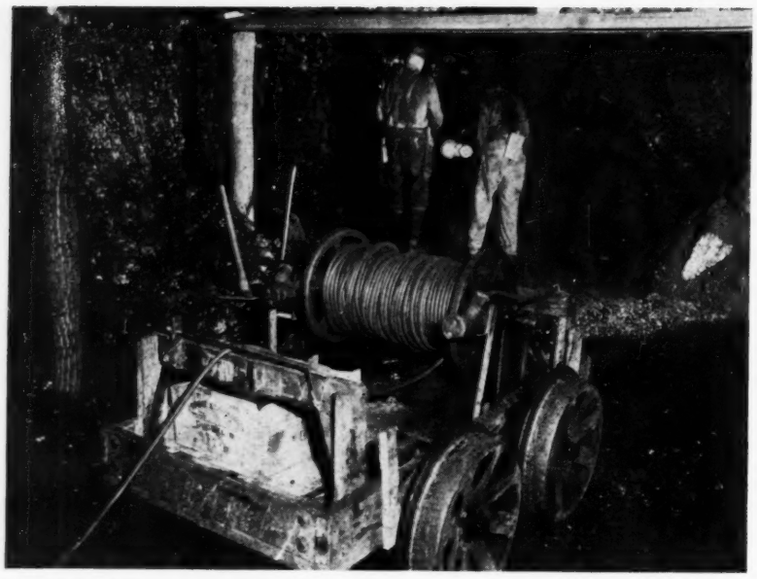
Timbermen are followed by the trackmen, who work in crews of two and extend the track to within 2 ft. of the face, which process is facilitated by providing 8-, 6-, 4- and 2-ft jumpers in addition to the regular 16-ft. rails employed. The trackmen also do any switchlaying required, using in new work standard steel ties with four special switch and switchstand ties. For other details of room track, see article beginning on p. 57.

Top cutting, normally accompanied by double shearing, follows track extension. Shearing has been found necessary because the coal, although soft and friable, is extremely hard to break up and roll out when either top or bottom cut only. In solid work, the shear cuts are made on each rib, as shown in Fig. 5. In pillar places, one shear is made next to the fender, with the other 6 ft. in from the opposite rib. Making the extra shear requires only four to seven minutes, and has been very successful in reducing shooting costs and improving loading conditions.

After inspecting a place for gas, machinemen first drill a roof hole to the slate to see how much top coal is present. This rule was adopted to make sure that sufficient

Fig. 5—Standard cutting and drilling plans used at Isabella.





Hand-held drills are used at Isabella. The truck is fitted with a permissible reel. Old powder box shown contains sand-filled tamping bags.

Wiring up shots in a rib place, showing use of the 15-ft. auxiliary cables which are attached to the detonator wires.

top coal (not less than 8 nor more than 12 in.) is left to support the drawslate. And when the coal is not crushed, in the absence of other conditions preventing, machine men are supposed to cut a crossbar hitch on one side of the place by extending the top cut into the rib. After a place is cut and sheared, the bar, still in the shearing position, is dropped and moved back and forth across the face to push the bugdust to the sides, thus saving the drillers some shoveling. All cutting machines are equipped with either a 450- or 750-gal. trailing tank with a self-priming centrifugal pump and nozzles on the cutter bars for spraying the bugdust as it is pulled out of the kerf. Water consumption is approximately 3 gal. per ton of coal cut. A permissible junction box and disconnecting switch is used between tanks and cutting machines proper.

When the machine men have cut the place as in Fig. 5, the drillers and shotfirers come in. These men either work together or with the drillers a little ahead. The bugdust is first shoveled back to make room for hole placement and drilling operations just above the bottom. During this activity, the shotfirer leaves cap bag and powder sack outside the place. Three holes normally are drilled per place in solid work, as shown in Fig. 5, with one above the characteristic Pittsburgh-seam bands, which occur about the middle, and two below. Five holes, however, are drilled in pillar places, and are placed about as indicated in Fig. 5. Conveyor-type augers 11 ft. long with diamond-point molefoot bits are used.

Permissible Shooting the Rule

Holes are loaded with 1¾x6-in. medium-velocity, water-resisting permissible powder, and all shots are charged and fired in a "permissible" manner. Usual number of sticks per place is given in Fig. 5. Sand-filled dummies are carried in boxes on the drill truck, and as the drillers go out they leave enough to tamp up the holes. Dummies are filled in a building on the surface by a vibrating dummy-making machine. No. 6 electric blasting caps are used for firing shots, and after the holes are tamped up, the leg wires are connected to 15-ft. lengths of rubber-covered cable with the ends shunted so that the leads to the various holes, which are fired singly in succession, using a permissible shotfiring unit, can be found after the first hole is fired. The cables are covered with bugdust to facilitate pulling them out of the coal after shooting is completed. Battery clips are used on the ends of the main shotfiring cables to facilitate making connections, and the shotfiring cables themselves are U. S. Navy-specification shooting cables with a sheath designed for under-water service. Conductors are steel cables surrounded by copper and are equivalent to No. 14 wire. The order of firing holes is indicated in Fig. 5. After shooting, the place is ready to load unless the top coal breaks and the slate comes down, in which case the trackmen or timbermen come in and throw off as much as possible.

In serving the loading machines at Isabella, the gathering locomotives (see article beginning on p. 57 for design details) handle a five-car trip as a maximum. The rule is to take in one more car than the place is expected to make, which generally is three to four. As cars are filled, they are pulled out and spotted on the nearest empty track, which may be in a crosscut if the rooms are deep enough, in an adjacent room or on the butt entry, whichever is most convenient. Such cars as are loaded are made up into trips by the swing locomotive when it brings in empties.

TRANSPORTATION

+ At Isabella Mine

APPRECIATING that transportation nearly always is the difference between good and mediocre or poor mechanical-loading performance, officials of the Isabella mine of the Weirton Coal Co. adopted a 10-ton mine car—the first of this size ever installed underground in a United States coal mine—as one of the major steps in its modernization and mechanization program, supplementing these with gathering locomotives especially designed for operation behind loading machines and heavier track better fitted to carry track-mounted equipment in the working sections. Between the working sections and the dump, improvement of main-line haulways already in place included not only the use of treated ties and rails properly aligned and ballasted on a good subgrade but also improvements in roof support, not only with the idea of permanency but also to eliminate eventually all legs on main lines. For the final stage from mine to preparation plant, an underground rotary dump and slope belt were installed.

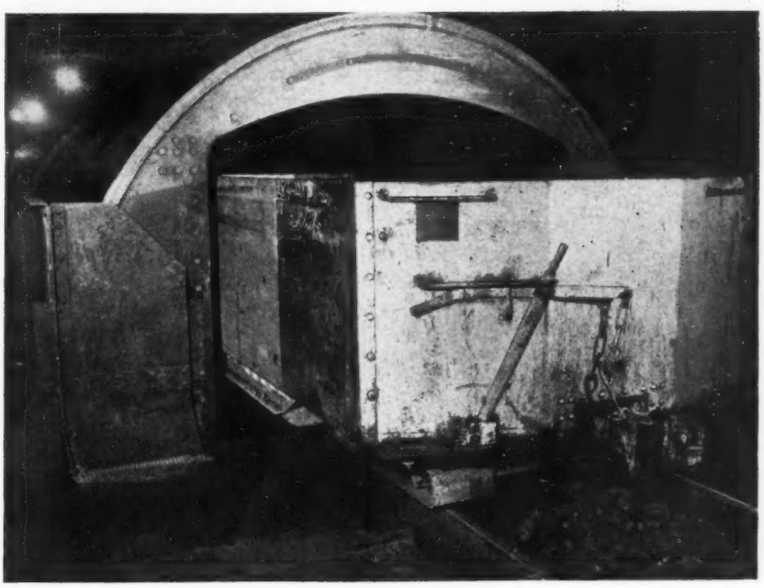
Old Slope Utilized

Isabella mine originally was served by two hoisting shafts, although only one was used in coal production in late years, with the other available for hoisting house coal and slate. Shaft depth in both cases was close to 150 ft., although hoisting distance was 258 ft. at No. 2 and 240 ft. at No. 1. Both shafts were equipped with 400-hp. hoists, and the output from No. 2 averaged 4,000 tons per shift, with 4,512 tons, representing 1,462 dumps, as the record for a 7-hour shift. No. 1, as a rule, handled perhaps 50 to 70 cars of slate and 5 to 10 cars of house coal per shift.

To supplement the two shafts, a man-and-material slope was driven to the bottom by the previous owners. So, in revising the transportation system at Isabella, advantage was taken of the presence of this slope and it was converted into a combination of conveyorway, manway and material opening, as studies indicated that in this particular case this method of handling coal was more economical than cage or skip hoisting. Converting the slope necessitated removal of the old timbering, which was about to collapse, cleaning up the broken material over these supports and widening the slope an average of 5 ft. Present arrangement of the slope is shown in Fig. 1, which also illustrates the original dimensions of the supporting timbers.

The supply track was laid with 60-lb. rails on slag-ballasted treated ties. Cross rails were welded under the main rails on about 6-ft. centers. The concrete slab under the conveyor line was extended to form the manway stairs, and a reinforced-concrete wall about 5 ft. high, equipped with light standards at intervals, was erected along the supply track. The manway stairs have a 6-in. rise and a 24-in. tread, which was determined by building wood steps and trying them out prior to settling on the design, the purpose being to find the most satisfactory dimensions for a natural step. Permanent roof protection was assured by guniting the roof and sides. In general, the gunite was 2 in. thick, wire-mesh reinforced, with 4 in., double reinforced, in one particularly bad spot which caved 30 ft. high.

Front end of a 10-ton Isabella mine car, showing blackboard (on clearance side), steps and handrails on each corner, brake lever, automatic coupler and coupler-release lever (brought out under brake rack for maximum protection against falling lumps).



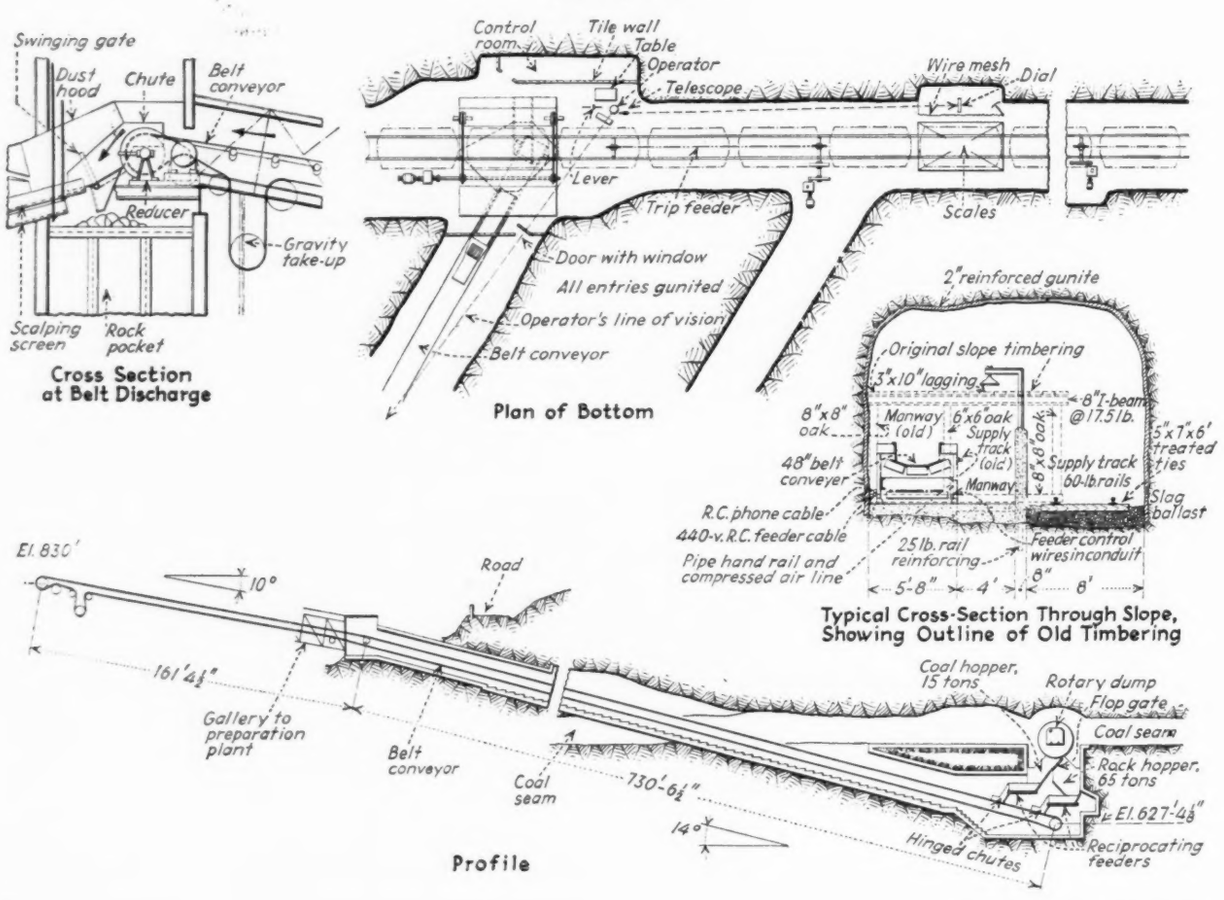
The slope conveyor consists of a 48-in.-wide rubber belt (8-ply, 42-oz. duck, $\frac{3}{16}$-in. carrying cover, $\frac{1}{16}$-in. reverse cover and breaker strip) carried on anti-friction-bearing-equipped conveyor and return rolls with nipples for grease-gun lubrication. Length of the conveyor is 892 ft., center to center of pulleys. It is designed to handle 18x16x12-in. coal lumps and 24-in. pieces of rock. Inclination in the slope is 14 deg.; from the top of the slope to the preparation plant, 10 deg. The belt is driven at 275 f.p.m. by a 125-hp., 875-r.p.m. motor in the tipple through a double-reduction herringbone speed reducer. This motor is controlled by the preparation-plant operator. A signal and telephone system enables the operator to coordinate belt operation with dumping on the bottom. The belt also is used to hoist mine rock, and an interlock system prevents dumping rock over the shakers or coal into the slate bin in the preparation plant. Belt demand is 74 kw. loaded and $17\frac{1}{2}$ kw. empty, compared with an average of 207 kw. for the coal hoist, on which the momentary peaks were 475 kw.

A feature of the main bottom and dumping station is one-man operation. Cars are dumped in a rotary dump designed to handle the new 10-ton steel cars. Loaded trips coming into the bottom stop over a 10-hp. hiker feeder 350 ft. uptrack from the dump. The locomotive here uncouples and proceeds on a run-around track to the empty storage track. The dump operator can then feed this trip at will to a 20-hp. car haul at the dump with a capacity of 50 loads on the prevailing light favoring grade. Both car hauls and the dump operate at a slow speed, which will be a decided factor in cutting maintenance cost. This slow speed is made possible because each car holds as much material as 2 to 4 ordinary mine cars.

Before the cars go into the dump, equipped with a hydraulic brake ($\frac{1}{3}$-hp. motor and limit switches for slowing down and stopping and a pushbutton for starting the 25/7-hp. two-speed dump motor), they are weighed on a track scale equipped to throw the weights on an illuminated screen. This scale is 50 ft. from the dump, and a transit telescope is mounted at the dumper's station, through which the weights are read. Weighing the cars facilitates keeping them loaded to capacity, as each car is marked with its origin, date and shift, and therefore the responsibility for light weights can be placed squarely at its source. Recording the point of origin also permits an accurate check on sections originating excessive quantities of slate in the coal, facilitating the initiation of the proper corrective measures. Cars of slate are weighted the same as coal; any cars containing over 12 tons are reported to the proper section foreman, who takes steps to prevent a continuance of overloading.

Underneath the dump is a 15-ton coal hopper and a 65-ton slate hopper. A flop gate operated by a 2-hp. motor is used to change from one to the other. Coal is fed onto the belt by a 10-hp. 42-in.-wide reciprocating feeder operating at 66 6-in. strokes per minute. A similar feeder, operating at 55 $4\frac{1}{2}$-in. strokes per minute and interlocked with the coal feeder by limit switches, feeds the slate out of the slate hopper. Each feeder has a capacity of 425 tons per hour. A plan and profile of the belt installation and dumping arrangements is given in Fig. 1, while the general plan

Fig. 1—Plan, profile and cross-section of the new Isabella slope and dumping arrangements.



of the bottom, including shop, man-trip loading stations, dispatcher's quarters, etc., is shown in Fig. 2. The entire bottom is gunited to a thickness of 1 in., without reinforcement except in wide places, where the thickness is increased to 2 in. It will be noted that the new bottom had to be driven at approximately right angles to the two shaft bottoms and previous slope bottom.

Track at Isabella, constructed in accordance with American Mining Congress standards, is divided into three classes: A, B and C. A and B track is used on main lines and on secondary roads traveled by swing locomotives. These roads are shown in Fig. 1, p. 52. Class A track consists of 60-lb. or heavier rail laid on 5x7-in.x6-ft. oak ties treated with chromated zinc chloride or Wolman's salts. Some earlier tie installations employed creosote dipping as a preservative. Track gage is 44 in. All Class A track is laid on a subgrade at least 5 in. thick below the bottoms of the ties. Ballast consists of slag or mine waste, with the inclination now toward the latter, which has been found to pack tightly, making it an excellent material for the purpose, especially as the main haulways generally are dry and the floor is neither excessively soft nor hard, thus offering no difficulties on that score.

Clearances Are Watched

Minimum clearances of 30 in. from the outside of the widest piece of equipment (the mine cars) and the rib or timber are maintained on one side of each roadway, with 12 in. on the other side and 6½ ft. above the rail on all main lines. Bonds are being eliminated on main-line track in favor of cross members of old 25- or 30-lb. rail welded to the bottoms of the track rails on approximately 6-ft. centers. In addition to eliminating bonding, these cross rails also give greater lateral stability, prevent rails from turning over or spreading and, in general, result in a more rigid installation.

Complete wood tie sets are used in laying Class A turnouts. Nos. 3, 4, and 5 cast-manganese-steel shrouded frogs with low-type parallel-throw switchstands are used on all main-line turnouts. Switch-position indicators, employing colored reflector buttons, are in process of installation. Nos. 3 and 4 frogs, however, are confined to sidetracks and other points where the traveling speed is low. Turnouts on main haulways are limited to as few as possible, while on the main bottom and the two main sidetracks an effort has been made to so design the track

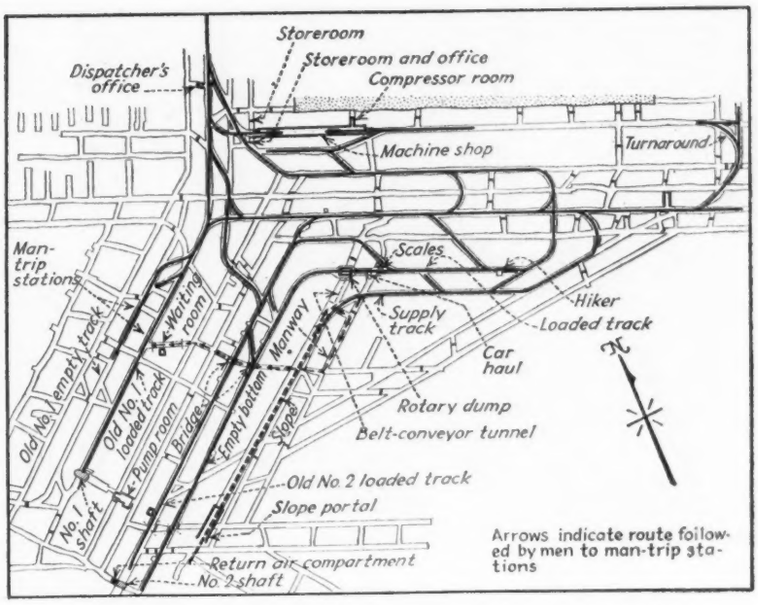


Fig. 2—General plan of new bottom at Isabella in relation to previous bottom layouts.

that trips of cars trail through the switch points, wherever possible, rather than against the points.

All Class A and B track is laid 12 in. to the right of the center line of the 12-ft.-wide headings to permit establishment of the necessary clearance on the wide side. Also, turnouts for all three classes of track used are laid in definite relation to previously set spads. This is necessary in the case of A and B track and particularly in case of Class C to make sure that there is no interference with timbers, and vice-versa; that proper clearances are maintained, and that correct degree of curvature for best equipment travel is provided.

Ditches Kept Off Main Lines

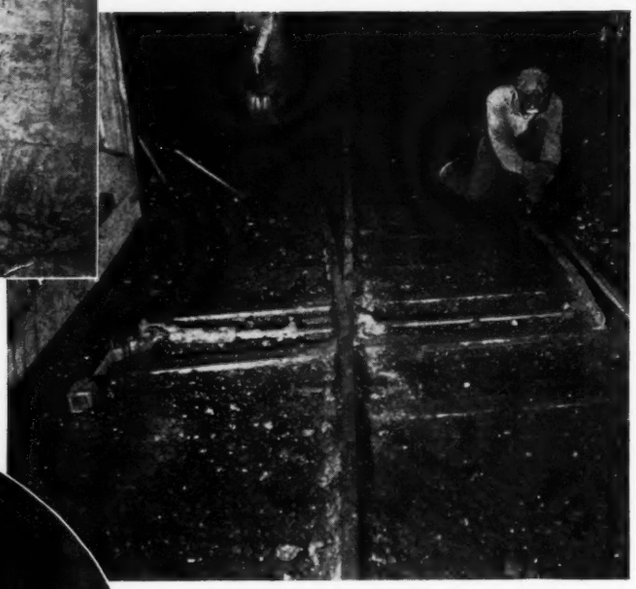
Where necessary, ditches along main lines are being constructed in parallel headings. The mine, however, is fairly dry. In this connection, most of the water in the future will be handled through a 10-in. borehole (8 in. inside the casing) recently put down to the West Mains at 44 North (Fig. 1, p. 52), which is expected to be the lowest point in the mine, as it is at the bottom of the main syncline. Depth of the borehole is 160 ft. One of the two 500-g.p.m. main pumps in use in the mine is now being located at the bottom of this borehole and will handle most of the water, leaving the small remainder to a similar pump at the bottom of one of the old hoisting shafts. Several gathering pumps will be eliminated by this move and by the construction of a number of shallow ditches at strategic points. When the new system goes into operation it is planned to use the main pipe-line system, with some additions, for filling the cutting-machine water tanks and for supplying the car sprays on the partings. Town water then will be used, reducing possible corrosion and deposition of sediment in nozzles, etc. Also, several pumps which now have to be operated continuously to supply mine water for sprinkling will be taken out of service.

Class B track at Isabella consists of 40-lb. rail on 4x6-in.x6-ft. treated ties with a steel tie about every 6 ft. for added strength. Subgrade depth in this case is at least 2½ in. under the tie bottoms, and mine-waste ballast is employed. Turnouts are laid with No. 2½ frogs identical with those on main lines, as well as smaller-sized switchstands of the same type. Standard wood ties are used in laying the turnouts, except that two long ties are provided for the switchstand. Steel ties are interlaced with the wood ties wherever possible. Regular welded bonds are employed on this class of track.

Class C Track Standards

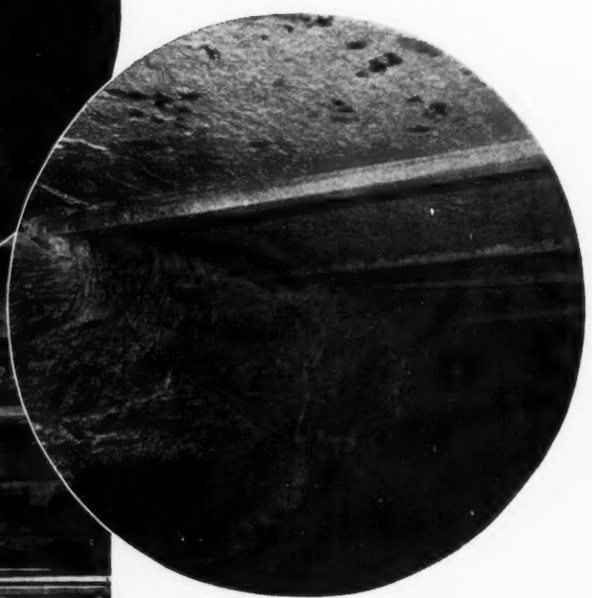
Except for some 30-lb. equipment now in the process of being used up, and confined to one section, Class C track consists of 40-lb. rail on 3½-lb.-per-foot steel ties. These ties have depressed ends, which tend to prevent sliding, bowing up in the middle, and the catching of trailing cables under the ends. The 40-lb. rail has been found necessary in view of the heavy track-mounted equipment employed.

60-lb. main-line turnout, using low-type parallel-throw switchstand and cast-manganese-steel shrouded frog. This turnout had not been cleaned in six months. Ties are treated.



40-lb. steel-tie turnout with mine-made welded frog in a butt heading. All turnouts are equipped with parallel-throw switchstands.

View of the bottom of the Isabella slope, with material track at left, stairs in center, and belt conveyor at right.



One end of these rail crossbars in a butt heading rests in a hitch made by the top-cutting machine.

Showing how old cribbing was caught up on new I-beams resting on pins and stringers put in the rib with a hitch drill.

This rail is all specified to contain not over 0.50 carbon to ease bending and prevent breakage. To facilitate handling, full-rail length has been set at 16 ft. and sufficient 8-, 6-, 4- and 2-ft. lengths have been provided to give each place an adequate supply for making extensions.

Standard American Mining Congress turnouts are employed, and are laid on regular steel ties, with four special ties under the switches. All switches in the working sections also are equipped with the low-type parallel throws previously mentioned, and in fact all turnouts have switch throws both inside and outside the mine. No. 2½ frogs are used, and these frogs now are made at the mine by welding rail sections, previously bent and burnt as necessary, to a steel baseplate. Breakage previously encountered as a result of using the regular rail sections has been eliminated by purchasing rails rolled to not over a 0.50 carbon specification.

The welded frogs, of course, are not of the shrouded or flange-bearing type, but no difficulty has been encountered with pounding or derailments. One factor in this is the use of 4-in.-wide treads on all wheels with a flange height of 1¼ in., except for 2-in. flanges on cutting machines.

Haulage Roads Gunited

Gunite 1 in. thick, without reinforcing, is being placed on all haulage roads with life of about twenty years or more, except where the top is sandstone. On semi-permanent roads, the standard practice is 80- or 85-lb. relaying rail crossbars placed in holes made with a hitch drill. The object is to eliminate as far as possible the use of legs. Two holes usually are drilled for each bar, one on one side of the heading and one on the other. Many round wooden crossbars have been replaced and the cribbing caught up on rail crossbars or, where the weight is heavy, on recovered I- or H-beams formerly employed. Rail crossbars, however, now are standard equipment. In catching up old beams and cribbing, the pin-and-stringer system usually is employed, as shown in an accompanying illustration, although, if conditions are bad and particularly if much rib sloughing is to be expected, bars are installed singly in pairs of holes. Stringers, where possible, are supported on three pins, so that a bearing still is available even if one pin should give way. Stringers supported on three pins usually are 15 to 20 ft. long; if two pins are used, the length usually is 10 ft. On butt headings particularly, and as far as possible in rooms, the practice is to swing the cutter bar over into the rib on one side far enough to make a hitch for one end of the bar. The other end then is set on a post.

13-Ton Haulage Units

Haulage motors at Isabella comprise three 13-ton completely rebuilt units. Only one of these is operated in main-line service under the present working conditions, running from the bottom to two main sidetracks 9,000 and 7,000 ft. away. From there to the face, swing and gathering haulage are taken care of by ten 8-ton explosion-proof trolley and cable-reel units, of which nine are in regular use, three in swing service and six for gathering. Two 8-ton explosion-proof locomotives of another make, changed over from 500 volts and equipped with late-type accessories, are available for extra service. Jerry service is handled by two 8-ton trolley units, which still have the original 500-volt motor windings.

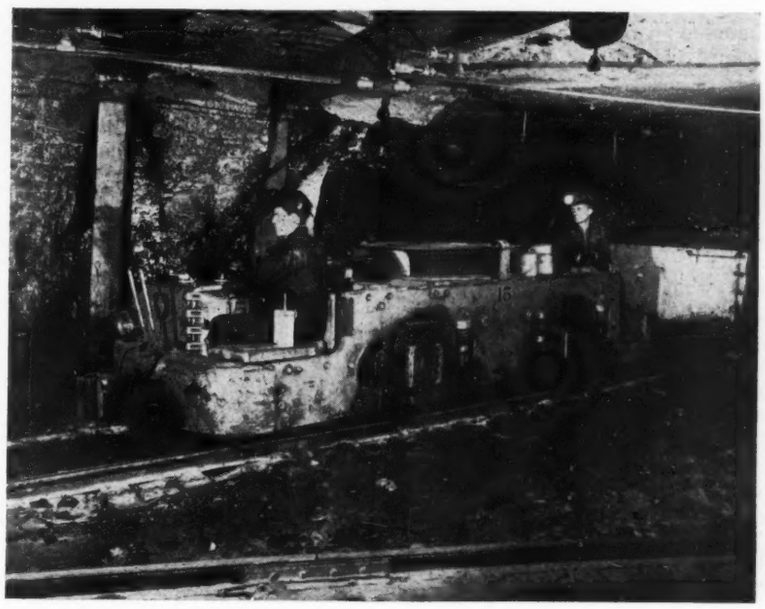
The gathering and swing locomotives have a rated full-load speed of 4 m.p.h. and were specially developed in conjunction with the mine management for serving loading machines. The conventional controller was replaced by a reversible unit operating the motors in parallel only, and to reverse the direction of travel it is necessary only to move the single controller handle in the opposite direction. The controls also are arranged for plugging on the first point, with an overload trip in case the controller is moved through this point too quickly. The conventional handwheel-type brake mechanism was replaced by a quick-acting lever-type brake on the top of the locomotive. A quick-adjusting mechanism was provided on the brake to facilitate placement of the brake lever in the most convenient position for the operators. The sand lever is under the operator's foot, the whole arrangement simplifying operation and enabling the locomotive to follow quickly the movements of the loading machine. Special care was devoted to providing safe and comfortable quarters for the snapper, opposite which is a compartment for jacks and tools.

The locomotives are equipped with gearless reels. Wheelbase is 66 in., which has proved out well in practice. These locomotives, as well as all other new track-mounted equipment, including cars, were designed to operate on curves with a minimum radius of 25 ft., although none less than 35 ft. normally are used in the mine.

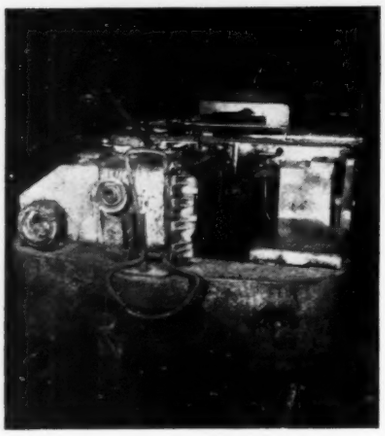
10-Ton Cars Used

Coal and slate are hauled in 182 steel cars with a capacity of ten tons —the first car of that size to be installed underground in a United States coal mine. Average loading to date, including both light and heavy cars, is 9.2 tons, with some sections averaging 10 tons or more at times, this depending mainly on the seam height in each section. The cars were designed to carry safely 12 tons of slate. The total number purchased gives some surplus storage capacity,

Specially designed explosion-proof cable-reel locomotive used behind loading machines at the Isabella mine.



thus benefiting face operations. In addition to the usual benefits growing out of some reduction in changing time, the big car compensated to a considerable degree for lack of skill in handling on the part of green motormen and snappers, because once in the place they stay there for some time. They also eliminate the pressure for fast handling present in working with a small car, as the changing cycle is a much smaller proportion of the total.



Front view of Isabella gathering locomotive, showing single controller handle, lever-type brake handle on top of machine and comfortable motorman's seat.

A very noticeable reduction in spillage of coal along the haulageways is another outgrowth of the use of the new car equipment at Isabella, resulting from: (1) the width and length of the cars; (2) the four spring-mounted flexible trucks used, which cushion all shocks; and (3) the use of spring- and friction-type draft and buffing gear. Track, in the expectation of the mine management, will have to be cleaned only about once a year.

Derailments of cars, judging by usual coal-mine standards, have been very few in spite of the fact that considerable main-line track has not yet been reconditioned. The average is about two per 24-hour period, taking in all working shifts. Pump jacks and a short rail are used for rerailing, which normally takes about 10 minutes. Loaded cars seldom derail, and in the majority of cases derailments are due to dirty track near the face, an unusually low joint or running off the ends of the rails when storing cars in a room.

The cars are featured by an unusually strong and rigid body construction and yet the weight is only 7,760 lb. each. Dimensions are: length, coupler face to coupler face, 15 ft. 10½ in.; outside body length, 14 ft. 4 in.; outside width, 7 ft.; height over the rail, high end, 55 in., and at low end (cut down to receive loading-machine conveyor), 44 in. Height when the car is loaded to 10 tons is reduced 1½ in. as a result of spring action. Track gage is 44 in.

The body of the car is supported directly over the rail on each corner by four two-wheeled trucks. Wheel diameter is 10 in., the distance from center line to center line of front to back truck pivots is 9 ft., and the wheelbase of each truck is 27 in. The trucks are of the "axleless" type and are designed for operation on curves with a minimum radius of 25 ft. The design of the trucks is such that the two wheels on each car corner are mounted in a rigid frame. Thus the two wheels always move together in a vertical plane, although, depending upon track conditions, one wheel may be higher than the other. Tiebars across the car from both the front and back ends of the frames keep the two trucks on one end of the car parallel with each other. The trucks have a rocking movement for traveling over uneven track, a bodily vertical movement to provide for a spring action of 1½ in. from light to full load and a rotating movement in a horizontal plane for rounding curves.

A box-type draft column through the center of the car between each coupler-compression lug forms a rigid structure for taking buffing strains. This is supplemented by heavy side members, cross members, angles welded around the inside of the top edges, and the use of heavy copper-bearing sheets in the bottom (½ in.) and sides and ends (¼ in.) for maximum rigidity. Assembly was a combination of welding and riveting. Bottom sheets were extended on each corner to form steps for the snappers, who also are provided with handrails above each step.

The cars are equipped with friction-draft and spring-buffing gear and automatic couplers with a coupling-release lever brought out to one side of the car. This lever is placed under the brake rack to keep it from being struck with lumps of coal, which might possibly result in a trip being uncoupled in transit. Wheels are equipped with lubricated-for-life ball bearings. Truck pivots are lubricated about twice a year. To facilitate keeping track of the origin of the coal, a section on the clearance side of the car is painted with blackboard paint, as shown in an accompanying illustration, on which the necessary data are entered with chalk by the snappers.

A dispatcher is employed on each shift at Isabella to regulate the operation of all equipment over the main and secondary haulage roads; oversee the operation of main-line, swing and gathering locomotives; keep track of cars; prepare lunch-time and end-of-shift reports on operation; keep a record of mine-car repairs; see that locomotives are taken out of service for inspection on schedule; see that man-trips are made correctly and are ready when needed; grease man-trip cars and check condition on idle days, etc. The dispatcher also operates a mine-telephone switchboard, which supplements a general switchboard in the lamphouse on the surface. No equipment is allowed to move on main or secondary haulage lines without specific orders from the dispatcher.

Side view of Isabella gathering locomotive (in extra service on the bottom), showing snapper's quarters.

Isabella metallurgical-coal preparation plant. The blending plant is at the left, with the slope-conveyor gallery at the right.

PREPARATION

+ At Isabella Mine

BLAST-FURNACE operation, for maximum economy, requires a coke with a minimum of impurities, particularly sulphur and ash, and, equally important, a coke with a minimum variation in quality from day to day. To make coke with these qualities, coal with corresponding characteristics is a necessity. Goals in the installation of a complete blending, washing and dewatering plant at the Isabella mine of the Weirton Coal Co., which produces metallurgical coal for the by-product ovens of the Weirton Steel Co., therefore were a uniform product with ash, sulphur and moisture contents as low as possible consistent with recovery and economical plant operation. Further considerations were good design for strength and smooth running, both leading to lower-cost operation, along with safety and freedom from dust. In addition, refuse-disposal cost has been cut two-thirds by installing an aerial tramway. The preparation plant also complements mechanical loaders underground and thus enables this latter equipment to function at maximum efficiency.

Rated capacity of the Isabella preparation plant, equipped with two Simon-Carves washers and auxiliary equipment, is 308 tons of blended raw coal per hour, although at the time this article was prepared the feed from the blending plant was averaging 315 tons per hour. Rated maximum feed from the blending plant to the washing equipment, however, is 335 tons per hour. The operating objective is two continuous shifts of six to seven hours each for that part of the preparation cycle beginning with the blending plant to prepare the mine output, which is derived from two full seven-hour loading shifts. The loading machines are considered the limiting equipment at Isabella, and all supplementary operations, including preparation, are arranged so that they will not hamper the loaders through lack of capacity.

Continuous operation of the washing side of the preparation plant is facilitated, of course, by the blending equipment with its normal reserve capacity of 750 tons of coal. But the effect on the washing results was the major factor in the adoption of the blending plant, which assures a high degree of uniformity in rate of feed to the washing equipment, in addition to evening out to a considerable extent the quality of the raw coal and its size distribution, all of these factors in turn making for improved cleaning performance and greater uniformity in washed-coal quality.

All material going into the blending bins is under 4 in. in size, which means that all material handled by the washers and other subsequent preparation equipment also is less than 4 in. This condition is attained by passing all material larger than 4 in. over a picking table, where only pure rock, slate, tramp iron, wood, etc., are removed, and then running it through a crusher. Moisture reduction is accomplished by means of

normal- and high-speed screens, centrifugal dryers and a vacuum filter.

Although the blending plant and automatic reject controls on the washers, plus other operating provisions, go far toward providing nearly automatic maintenance of quality, regular analysis of the plant products to facilitate adjustments when necessary is the rule. Automatic sampling equipment for the raw coal, clean coal and refuse is installed to provide representative samples of these three materials. Complete weight control is made possible by mine-car scales on the bottom, house-coal scales on the surface, automatic weighing equipment on the conveyors from the blending plant to the washers and the barge-loading station, and barge gages. Refuse weight may be determined by difference, with a check by counting the number of bucket loads sent out. The weight-control and sampling systems installed in this plant probably make it the first washery ever to be so completely equipped.

Isabella preparation plant, designed and built by the Link-Belt Co. in cooperation with the M. A. Hanna Co.'s consulting engineers and the Weirton Coal Co.'s operating department, prepares coal from the Pittsburgh seam, averaging about 7½ ft. in total thickness. Of this total, not less than 8 in. and not more than 12 in. is left in place in the top, primarily for roof protection, although this top coal also is high in sulphur.

Raw-Coal Characteristics

The seam (Fig. 1) is overlaid by 1 ft. of drawslate, followed by 0 to 5 in. of "Rider" coal and a "checker" slate, the latter grading in places into sandstone. Beneath the seam is 6 in. to 2 to 3 ft. of fireclay, while a great number of hard, flinty horsebacks are present in the seam itself. Under mechanical-loading conditions, top, bottom and horseback material must be loaded from time to time, in addition to impurities directly in the coal. The latter consist of the characteristic Pittsburgh-seam double binder, along with other thin bands of bone and slate, and sulphur in various forms. Usually, however, the sulphur is grainy or granular, although certain thin high-sulphur-bearing slate bands also contribute to sulphur content.

Ash and sulphur in the raw mine output average 11.5 and 1.95 per cent, respectively. Maximum and minimum ash content, however, are 20 and 7½ per cent, while sulphur varies from 1.2 to 2.5 per cent. The

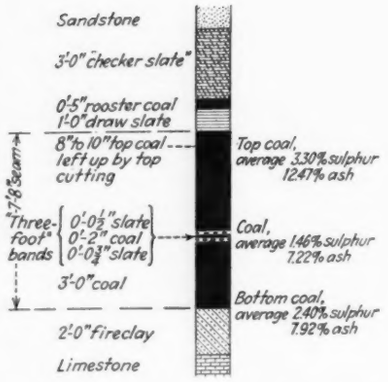


Fig. 1—Typical cross-section of the Pittsburgh seam at Isabella mine, showing principal banded impurities.

sulphur variation, incidentally, may take place from one cut to the next, and in general is subject, on the basis of available data, to wide fluctuations over relatively small areas.

To obtain data on which to base plant design, two complete cuts were taken out in the northeast and northwest sections of the mine. As the track-mounted top-cutting equipment was not then in service, the bottom coal, as was customary, was left in place and the top coal was mined, as compared to the opposite practice today. However, the dirtiest possible faces were selected and the coal was loaded without preparation to simulate as closely as possible expected mechanical-loading conditions. Each cut was brought out separately for (1) screen analysis and (2) sink-and-float tests on the various screen fractions. With this work completed, the next problem was combining the two so that the mixture would be representative of what might be expected from the mine. When the combination was made, the sulphur and ash just met the averages obtained from 50 barge analyses made for comparative purposes, indicating that the proper combination had been obtained.

Table I—Results of Test Showing "Blending" Action of Isabella Blending Plant

Time of Sampling	To the Bin Ash Per Cent	To the Bin Sulphur Per Cent	From the Bin Ash Per Cent	From the Bin Sulphur Per Cent	Tons in Bin
7:45 a.m.	8.65	1.87	9.82	1.47	292
8:15 a.m.	9.98	1.12	12.34	1.44	....
8:45 a.m.	9.89	1.01	10.58	1.64	....
9:15 a.m.	10.25	1.04	16.68	1.44	....
10:00 a.m.	10.02	1.56	15.45	1.91	....
10:30 a.m.	15.14	1.79	10.15	1.68	....
11:15 a.m.	9.42	1.58	12.56	1.84	....
11:50 a.m.	13.10	2.14	9.97	1.62	....
12:30 p.m.	17.75	2.11	10.34	1.68	351
Variation	9.10	1.13	6.86	0.47	....
Average	11.58	1.58	11.99	1.64	....

Ash and sulphur distribution by size fractions is shown graphically for each of the two cuts in Fig. 2. Fig. 3 shows graphically the washability data for the 4x0-in. fraction, excluding the plus-4-in. material on the theory that, even though it was to be crushed after picking and added to the natural minus-4-in. material, the latter would present the real cleaning problem. From the standpoint of sulphur elimination, the distribution in Fig. 2 indicates that as the coal is reduced in size a greater reduction is possible up to a limit of about 0.95 per cent, which is the combined organic and sulphate figure, the former averaging about 0.92 per cent and the latter 0.03. However, crushing to about ⅛ in. or smaller, the theoretical limit for maximum sulphur elimination, of course brings in the problem of handling large tonnages of small material, in itself impracticable from the cost standpoint. Incidentally, Isabella preparation officials subscribe to the contention that mechanical cleaning cannot actually be carried on for sulphur reduction *per se*, but rather that washing necessarily is done to reduce ash, in the course of which a certain sulphur reduction is obtained.

Cleaning-Plant Objectives

On the basis of the preliminary studies, the Isabella preparation plant was set up to give an ash of 7.50 per cent and a sulphur of 1.40 per cent with a recovery of close to 95 per cent of the coal fed to the washers when separating at a gravity of 1.50. In addition, a surface-moisture limit of 5 per cent on the coal as loaded into the barges was established. In actual operation, ash averages around 7.37 per cent, and sulphur around 1.23 per cent, with 5 per cent surface moisture. The first coal was run through the Isabella plant on Oct. 23, 1937, and on the basis of data collected since that time the curves reproduced in Fig. 4 show the probable deviation from the norms in the case of ash and sulphur. Fig. 5, on the other hand, shows graphically the actual ash and sulphur content of the product as loaded for shipment during the month of March, 1938.

Raw coal, after being moistened while cut and sprayed twice en route to the dump, is delivered to the Isabella preparation plant by a slope belt (p. 57). Mine refuse also is brought out on the same belt and is shunted to the proper bin by a flop gate in the chute leading to a flexible-hanger scalping screen. The

latter screen (for details of this screen and other equipment units in the plant, see Table II) separates the feed into plus- and minus-4-in. fractions. The minus-4-in. coal is discharged onto a belt leading up to a tripper over the blending bin. Lump, on the other hand, after traveling down the screen, falls onto a flat-top apron-type picking table, where only heavy slate, iron and wood are removed so that they do not have to be passed through the lump crusher (see below), leaving bone, bad coal, etc., in the coal. The scalping screen, incidentally, has a pitch of 15 deg. but is fitted with screen jackets set on a slope of 1¼ in. in 1 ft., thus giving a stepped effect. This design was adopted to provide a certain amount of attrition through making the lumps roll backward and forward a few times on each step and thus remove most of the pyritic sulphur on the surface, as well as as much of any sticky fines as possible. Illumination of the picking table is provided by three 400-watt mercury-vapor lamps which give 125 foot-candles per square foot of table surface.

From the picking table, plus 4-in. coal is discharged into a chain-driven double-roll spring-relief crusher, designed to crush coal having lumps as large as 18x16x12 in. to 4 in. and smaller with a minimum of fines. The speed of the rolls is 340 f.p.m. at the tips of the teeth. While the Isabella preparation plant is not required to make coarse coal, fines are a problem in that an increase in quantity would add to the handling problem, etc. Consequently, crushing is conducted so as to produce a minimum of fine material. One test, for example, showed 2 per cent of the crushed product to be over 4 in., 53

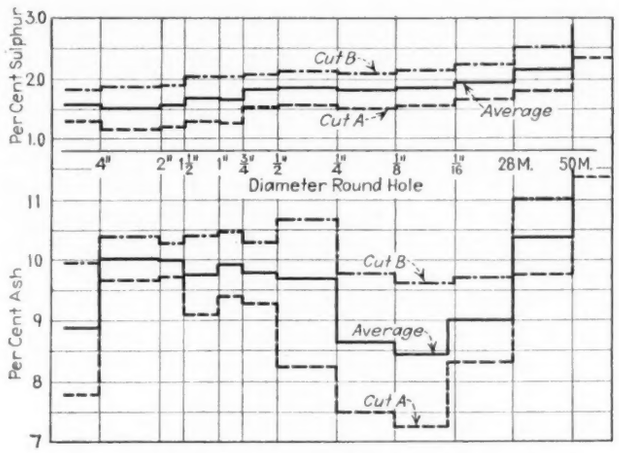


Fig. 2—Ash and sulphur distribution by sizes in the two test cuts obtained in Isabella mine.

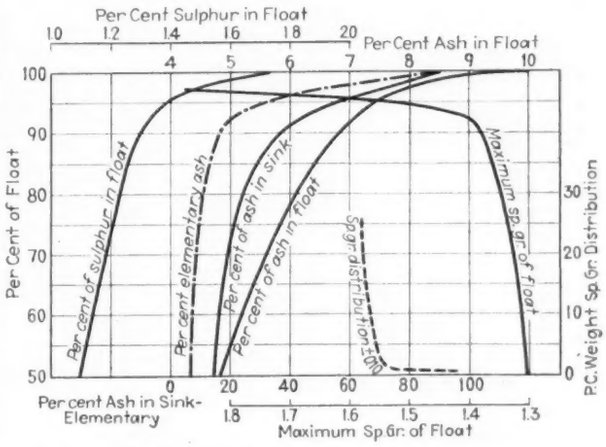


Fig. 3—Washability data on the 4x0-in. fraction of the combined test cuts shown in Fig. 2.

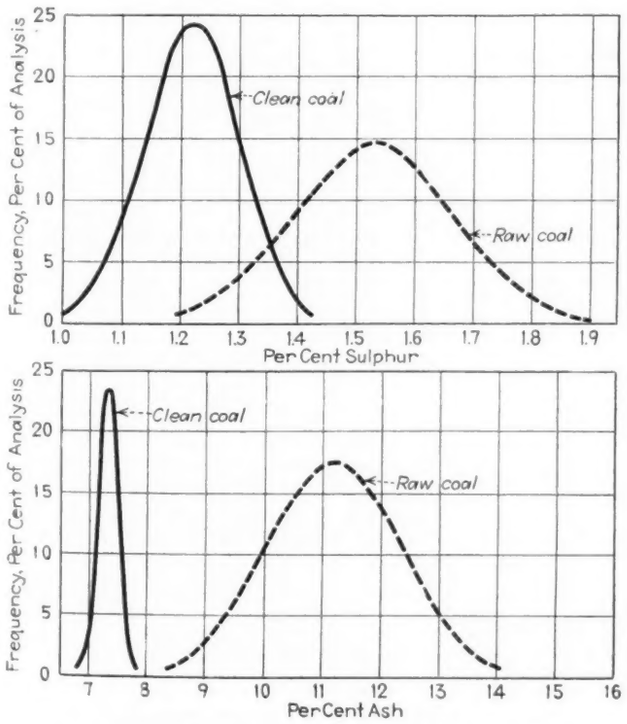


Fig. 4—Frequency curves, ash and sulphur results, Isabella raw and washed coal.

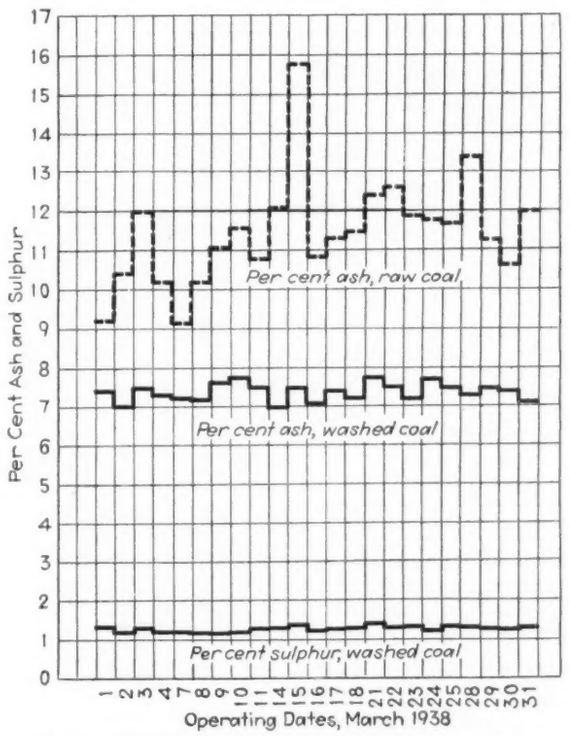


Fig. 5—Ash and sulphur content of Isabella washed coal for the month of March.

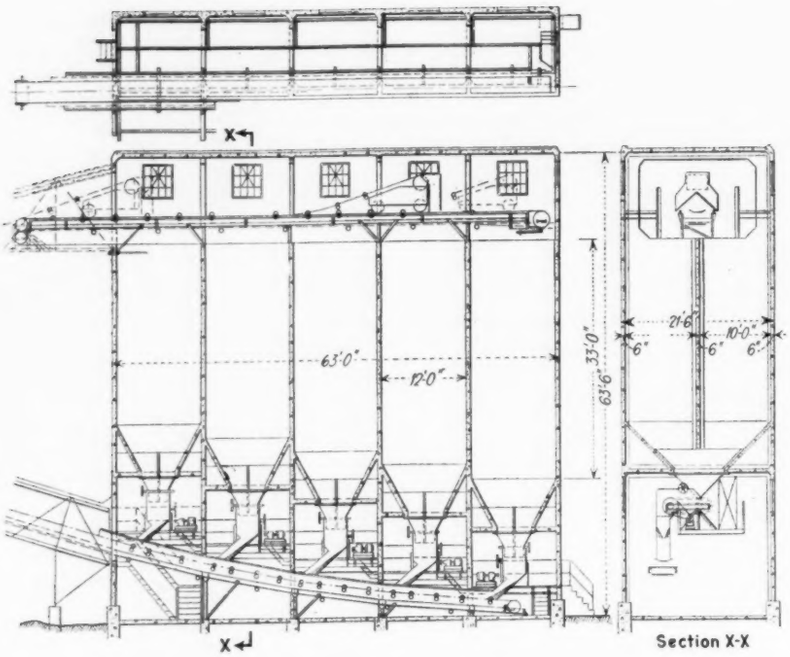


Fig. 6—General arrangement of the Isabella blending plant.

per cent between 4 and 2 in. in size, 38 per cent between 2 and ¼ in. and 7 per cent less than ¼ in.

How Coal Is Blended

Crushed coal joins the natural product smaller than 4 in. on the belt feeding the blending plant. This is a separate concrete structure to the west of the main preparation plant consisting of a five-compartment bin with a capacity of 1,000 tons. Size and general arrangement of the blending plant are shown in Fig. 6. An automatically controlled tripper moving back and forth on a track over the tops of the compartments lays the coal down in layers 1 ft. thick under normal conditions of feed. As indicated in Fig. 6, a partition in each compartment extends down almost to the bottom and a divided chute on the tripper splits the coal evenly between the two sides of the compartments.

When the blending plant was first put in service, it was found, contrary to the usual experience, that the coarse coal tended to concentrate against the partition. This resulted from the fact that the lumps traveling down the chutes struck the lips on the downspouts and bounced back to the center, whereas the fines either went straight down or bounced only a limited distance. Consequently, screens were placed in the bottom of the chutes to unload part of the fines before they entered the downspout, thus providing fines in the centers of the compartments to mix with the coarse.

Five 36-in.-wide apron feeders under the bin feed the coal onto a belt leading up to the washers. This belt is equipped with an automatic weigher to continuously record the tonnage fed to the washing equipment. The net quantity which may be withdrawn from the compartments before the highest-level feeder starts to cut out is 750 tons. This is the maximum washer reserve and allows the wet side of the plant to operate slightly more than two hours, starting with a full bin. By laying the coal down in layers and feeding it out from five separate points, a substantial degree of uniformity of impurity content and size distribution in the washer feed is obtained.

Results of one test made recently give an indication of the "blending" effect from the standpoint of ash and sulphur. During this test, coal was added intermittently at the top of the bin generally throughout the period, although it was being removed continuously at the bottom. Ash in the coal to the bin, as shown in Table I, varied from 8.65 to 17.75 per cent; sulphur, from 1.01 to 2.14 per cent. Ash in the coal from the bin ranged from 9.82 to 16.68 per cent; sulphur, from 1.44 to 1.91 per cent. Tonnage in the bin at the end of the test was somewhat higher than at the start and naturally the "average" analyses given in the table are not weighted averages for that reason.

Washing, which takes in, as pointed out above, all material fed to the plant with the exception of the refuse removed on the picking table, is done in two five-compartment Simon-Carves-type jigs. Coal is distributed to the two washers by a shaking-feed chute, selected primarily because of less headroom requirement. Each washer is rated at 200 tons per hour and is equipped with three refuse draws. The second and third draws are equipped with electric-eye controls. The first draw on each washer, however, is manually controlled, inasmuch as the material trapped out in this draw is subject to relatively wide fluctuations, which would mean, in case both this and the second draw were automatically controlled, that No. 2 draw quite frequently would be operated at times when little refuse had accumulated. Experience has shown that about 90 per cent of the refuse is removed in the first two draws, with the third draw polishing up the job.

Clean coal and water from the washers flows to three single-deck flexible-hanger shaking dewatering screens. Beneath the screens is a catch pan for the water and fines. Screen-plate perforations are: upper screen, 1¾-in. round; middle, ¾-in. round, bottom, $\frac{5}{16}$-in. round. Stainless-steel screen plate is used on the bottom screen because of its resistance to wear, as well as to rusting and consequent blinding. The size fraction off the top screen is discharged into a 36x48-in. double-roll crusher designed to break the coal down to 85 to 90 per cent through a 2-in. ring. Crushing, incidentally, creates more surfaces over which to spread the moisture and thus helps in the control of this element. After crushing, the coal joins the 1¾x¾-in. fraction made on the middle screen, either in chutes to railroad cars or on the transfer belt leading to the river-loading belt. Normally, all shipments are made by barge, although rail-loading facilities are available in case of ice or other conditions making water shipment impossible. Coal loaded in barges is weighed continuously by an automatic weighing unit on the transfer belt.

Fines to Hydroseparator

Minus-$\frac{5}{16}$-in. material through the bottom dewatering screen flows with the water to a 29-ft.-diameter hydroseparator with a capacity of 6,300 g.p.m., which separates it into $\frac{5}{16}$-in.x28-mesh and minus-28-mesh fractions. The former, which constitutes the underflow, goes into the boot of an elevator, which elevates it to two two-tray high-speed shaking screens

(300 1¼-in. strokes per minute) with a total screening area of 160 sq.ft. of ½-mm. wedge wire. Water overflowing the elevator boot is returned to the hydroseparator by a centrifugal pump.

Feed to the dewatering screens, which slope upward from the feed end ¼ in. in 1 ft., averages 50 per cent solids. The coal from the first tray of each screen averages 32 per cent moisture (dry basis) while the coal from the ends of the screens averages 25 per cent. The dewatering screens discharge into a conveyor feeding three centrifugal dryers (two in use) which reduce the surface moisture to about 7.3 per cent. Dried coal goes into a collecting conveyor either to the transfer belt noted above or to the car-loading chutes. Dryer effluent is returned to the elevator boot.

Overflow from the hydroseparator, containing nominally minus-28-mesh material, goes into a sump from which it is pumped up to a 200,000-gal. settling cone by two 3,500-g.p.m. circulating pumps. An auxiliary pump takes water from the top of the cone either for breaking up the slurry in starting or for use in a hose for breaking up froth formation on the cone water surface resulting from oil collected on the coal in the course of mining.

Handling Slurry

Clarified water from the top of the cone is returned to the washers, while the slurry settling to the bottom is pumped to a vacuum filter by a slurry pump. The filter, of the continuous type, is 8½ ft. in diameter with eight disks, is driven by a variable-speed gear, and has a rated capacity of 25 tons per hour. Surface-moisture content of the filter cake averages around 19½ per cent. The cake is discharged into a special conveyor with a center chain arranged to carry the cake either to the collecting conveyor under the centrifugal dryers or to the No. 3 refuse conveyor.

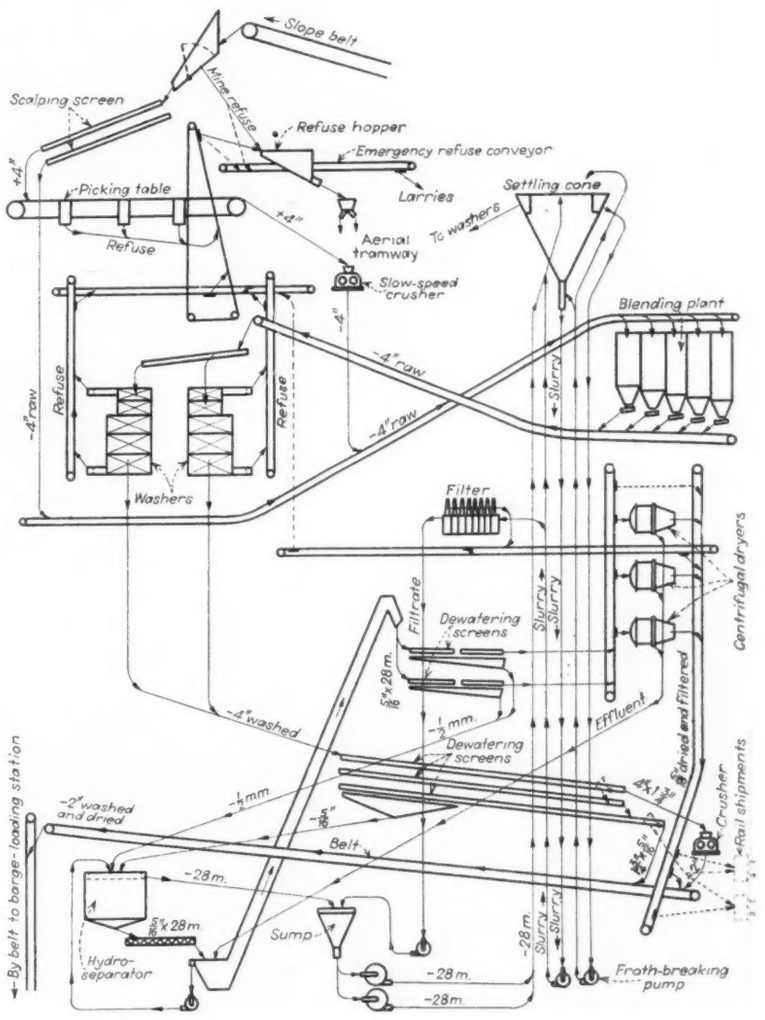
Installation of the filter permits the establishment of a closed preparation circuit in which all material is recovered. In fact, aside from refuse, the only material loss in the plant is the small quantity of fine dust discharged to the atmosphere from the cyclone separator in the dust-collecting system as the precipitated material joins the other fines in the dried-coal collecting conveyor noted above. Since there are restrictions against discharging water carrying coal or refuse into the river, provision has been made so that when it is necessary to drain the settling cone the contents can be routed to the filter for removal of the solids, which are sent to the aerial tramway for disposal while the water is run to waste. Make-up water for the plant is supplied through sprays on the coarse- and fine-coal dewatering screens by a 125-g.p.m. pump at the river.

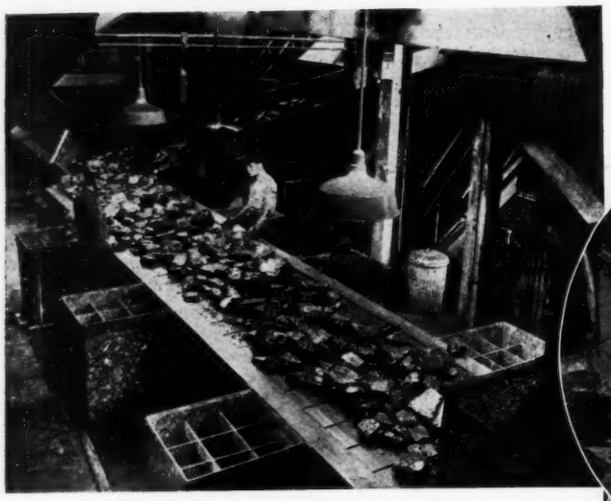
For control and record purposes, the washer feed, cleaned coal and refuse are sampled every half hour. To facilitate this work and ease the sampling task, three automatic samplers are employed, two in the chutes at the discharge ends of the washer-feed and transfer belts, respectively, and one in the chute to the No. 4, or final, refuse conveyor. These samplers consist of a splitter mounted on a plate carried on rollers to permit sidewise movement. The splitter itself consists essentially of two vertical plates with an opening about 12 in. wide facing the coal stream. Coal entering the splitter falls through a hole in the plate and into a chute system, where it is first split into two parts, after which one half is again subdivided, the final quarter falling into a sampling box. Both the sampler and sampling box are shown in accompanying illustrations. Equipped with rack-and-pinion gates and with shoveling plates in front, the sample boxes provide a convenient means of collecting and removing samples.

Operation of the sampler is controlled by a motor-driven timing element which starts a motor to drive the plate carrying the splitter across from one side of the coal stream to the other every half hour. A limit switch stops the motor upon completion of the cycle. Such rail shipments as are made from Isabella are hand sampled, as the mechanical sampler can be used only on barge coal. Comparing the results on washed coal has shown that mechanical sampling gives results in line with hand methods.

The sample-handling routine is as

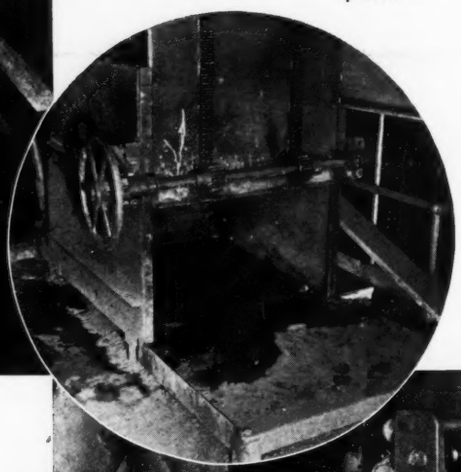
Fig. 7—Flowsheet, Isabella preparation plant.

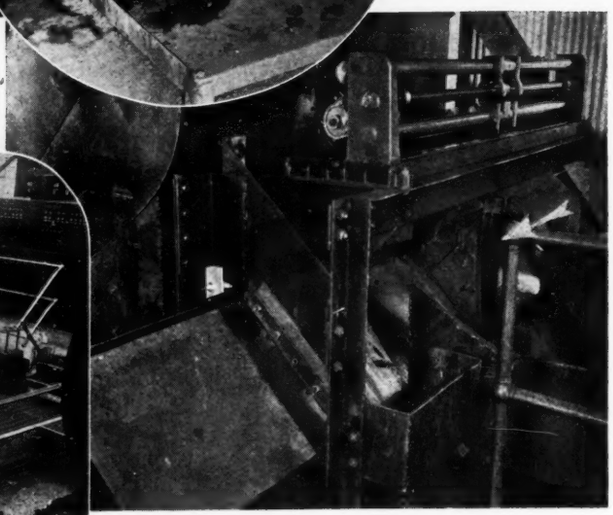




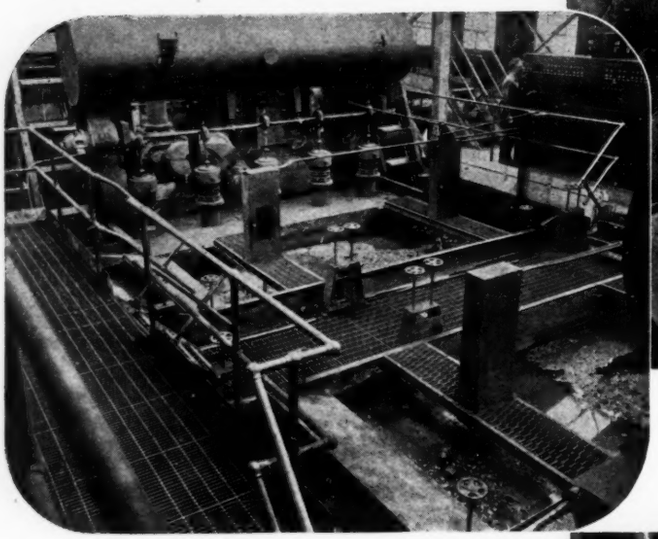
Rock, iron, wood, etc., are picked out of the plus-4-in. coal prior to crushing. In the back is the scalping screen with stepped screen jackets.

Sample-collecting boxes have rack-and-pinion gates and a shoveling platform.

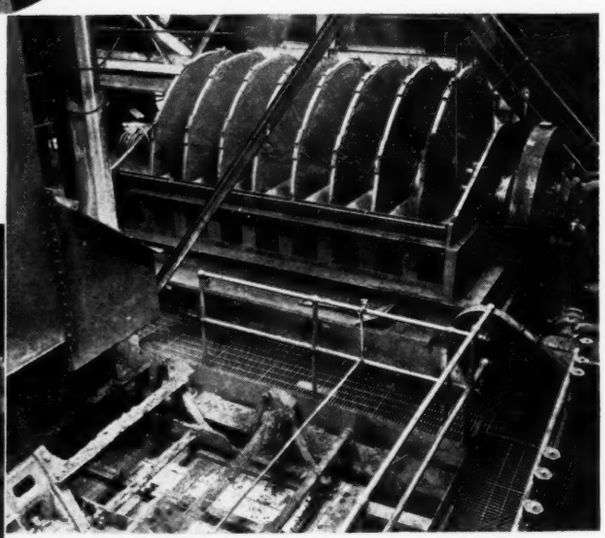




One of the three automatic samplers used at Isabella, with cover removed to show driving mechanism. The splitter, indicated by arrow, is carried across the coal stream on the movable plate shown.

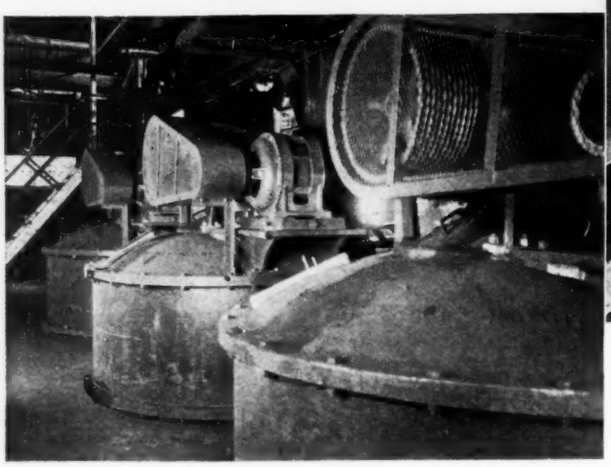


All coal at Isabella passes through these two air-operated washers fitted with electric-eye reject controls.



Slurry is dewatered in this continuous filter at Isabella. In the foreground is a portion of the dewatering screens for 5/16-in. x 28-mesh coal, which precede the centrifugal dryers.

Two centrifugal dryers, with a third in reserve, dewater 5/16-in. x 28-mesh coal at Isabella.



follows: make preliminary split at the sample box, retaining, in the case of washed coal and refuse, about 150 lb.; crush to ½ in. in mill; spread on cloth and quarter by hand; dry retained quarter; pulverize (second stage) in mill; split down in riffle buckets; buck down split retained; finish by grinding to minus 60-mesh in ball mill using rejected ball bearings. Jars are steel chromium plated inside. The sample then is ready for the analytical laboratory. All of the above equipment is installed on one floor of the preparation plant.

In spite of a month's delay in getting the work under way, the Isabella preparation plant was completed in five months instead of the six originally contemplated. This speedy erection, as well as the minimum difficulty encountered in starting up and in subsequent operation were due to a number of factors, of which perhaps the principal ones were the decision to use nothing but proved equipment, close contact between the Link-Belt Co. and the Isabella management during the design stage and the adoption of a system of marking structural members, timing deliveries and coordinating the activities of the various contractors and subcontractors.

As a preliminary, the assistant consulting engineer spent three months in the manufacturer's engineering department, in the course of which the plant was laid out in numbered sections. When fabrication started, a man was sent to the plant to check shipments to see that all necessary members were included. All steel was marked in such a manner as to show exactly where it belonged and in what position it should be erected in relation to other structural elements. And when erection started, a central clearing house was established to control the activities of all contractors and prevent interference. An attempt was made to foresee at least ten days to two weeks in advance when equipment was needed, whereupon the machinery was set in motion to insure its shipment on time.

The entire preparation plant was built on 12-in.-diameter concrete piles driven to the rock. Average depth was 32 ft. below the pile caps. The blending bin was set on a concrete mat, in the design of which a soil-bearing value of 2 tons per square foot was adopted. Concrete work on the blending bins was done by the sliding-form system, which permitted pouring the side walls, ends and partitions in six 24-hour days.

River Belt System Rebuilt

In installing the new plant, the river-belt gallery from the old tipple was retained but the original belt system was rebuilt. In this process, belt width was reduced from 48 to 36 in. and a new belt was installed, along with new anti-friction idlers, both standard and belt-training types.

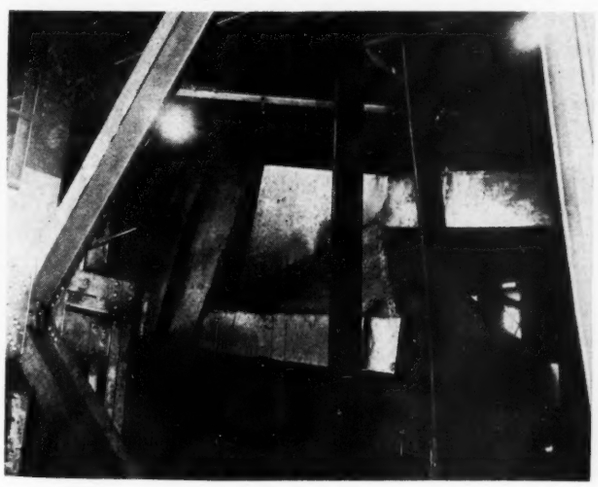
Harbor facilities were completely rebuilt. The old wooden ice breakers and piers destroyed in the winter of 1936 were replaced by structures made up of interlocking steel piling filled with rock. Concrete under the river loading station was replaced and the station was simplified to load in one lane through a single chute. Three light vertical centrifugal bilge pumps were purchased for dewatering the barges. In addition, a new and improved floodlighting system was installed.

Structural rigidity and elimination of vibration and sway were given careful attention in the design of the plant. Knowing the nature of the material on which the plant was to be set, balancing of reciprocating units was carefully watched. In the case of the fine-coal dewatering screens, for example, especial attention was given to taking care of the vertical component in operation. The screens were supported on box girders in turn resting on plate girders carried into the columns. Reinforcing plates were riveted to the webs of columns carrying very heavy loads, as in the case of those members supporting the settling cone, where the load on one column is 200 tons. Another instance of the measures taken in structural design was tying the bottoms of the tanks on the washers to the supporting columns to prevent sway due to motion of the large quantity of water in each tank.

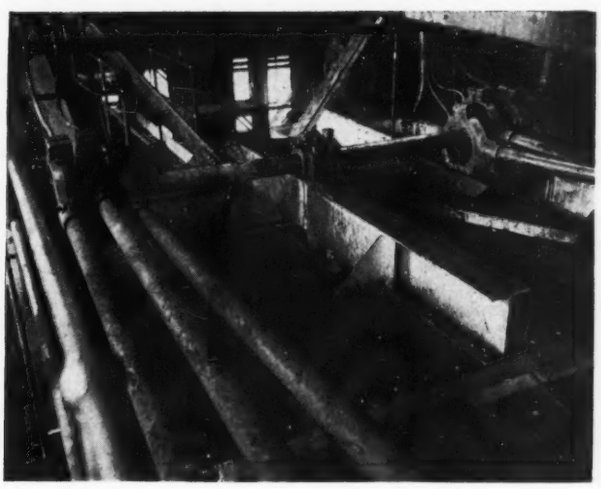
Measures taken to reduce maintenance included: supporting of all eccentric shafts on box girders to prevent whipping in operation; use of 0.40 carbon (0.50 in some cases) steel for all parts subject to wear in flight conveyors; use of white-metal liners in the bottoms and along the sides of the refuse conveyors; roller bearings in all motors and anti-friction bearings in all belt idlers, accompanied by the use of pressure fittings for grease guns at all points where lubrication is necessary. Also, all parts were standardized as far as possible with regard to type and size to reduce the number of spare units and repair parts carried in stock.

Safety, comfort and cleanliness were not neglected in plant design. Steel and concrete construction and asbestos-sheathed metal roofing and siding with an aluminum finish on both sides render the plant practically fireproof, in addition to reducing maintenance. Floors, with the exception of the washing floor, are made of 4-in. reinforced concrete, with 3-in.

Part of the Isabella dust-collecting system—hood over the scalping screen with duct to exhaust fan.



Method of supporting eccentric shafts to prevent whipping in the new Isabella metallurgical-coal plant.



reinforced concrete in conveyor galleries. Steel grating is employed on the washery floor, on all stairways and on certain other walkways, with toe cleats in the case of concrete installations. Railings along stairways, walkways, etc., consist of 1-in. pipe, and all moving parts, such as pulleys, gears, belts, etc., are totally inclosed in steel guards. About 550 sq.ft. of skylights was installed in the roof, with a liberal number of windows in the sides. Additional illumination is provided by light fixtures. Placement of these fixtures was done on the job.

Sufficient room around all equipment units for inspection, repair and lubrication was another prime consideration, along with convenient access to all parts of the plant. Adequate headroom received particular attention, with the result that only two unavoidable low spots exist anywhere in the plant. Ventilators in the roof reduce the temperature in the summer time and the aluminum finish on the outside also does its part in reflecting the sun's heat away from the plant interior, where the same finish improves interior appearance and illumination. For winter-time operation, a comfortable temperature is maintained by nine unit heaters fed with steam from a boiler fired by a household stoker. The heating system is designed to maintain an interior temperature of at least 50 deg. with an outside temperature of 10 deg. below zero.

Table II—Equipment, Motor and Drive Details, Isabella Preparation Plant

	Feet or Strokes Per Min.	Motors No.	Hp.	R.P.M	Drive
Scalping screen, 6 ft. wide, 23½ ft. long, 15-deg. slope, 96 sq.ft. of 4-in. round perf. plate, 6-in. stroke	130	1	10	860	V-belts
Flat-top apron-type picking table, 48 in. wide, 26 ft. c. to c.	40	1	3	1,165	Roller chain from double-red. (30:1) herringbone reducer
Plus 4-in. crusher, 30x36 double roll	340 (a)	1	30	690	V-belts
36-in. raw-coal belt (b), 231 ft. c. to c., 17-deg. inclined portion	327	1	30	1,160	Roller chain from single-red. (6.38:1) herringbone reducer
Tripper	11 (c)	1	2 (d)	....	Worm-gear reducer
Blended-coal apron feeders, 36 in. wide	22	5	3	1,165	Roller chains and double-red. (30:1) herringbone reducers
36-in. washer feed belt (b), 178 ft. c.c., 18-deg. inclination, 173½ ft. hor., 45 ft. 8 in. lift	306	1	25	1,150	Roller chain and single red. (6.38:1) herringbone reducer
Shaking feed chute, 6 ft. to 3 ft. wide, 20 ft. long, 4-in. stroke, 1½ in. to 1 ft. pitch	140	1	10	870	V-belts
Washer drives	....	2	10	1,750	Helical gear reducers (38.5:1)
Washer-reject gates	....	6	1 (e)	1,720	Worm-gear reducers
Washer blowers	465	2	50	1,175	Silent chain
Ref. convs. 1 and 2, 18x6-in., 27½ c. to c.	71	2	3	1,165	Roller chains and double-red. (30:1) herringbone reducers
Ref. conv. No. 3, 24x8-in., 52 ft. c. to c.	58	1	3	1,165	Roller chain and double-red. (30:1) herringbone reducer
Ref. conv. No. 4, 36x8-in., 3 corners	70	1	5	1,155	Roller chain and double-red. (21.41:1) herringbone reducer
Coarse-coal dewatering screens; upper, 6 ft. wide, 33½ ft. long, 144 sq.ft., 1½-in. perf. plate; middle, 7 ft. x 29 ft., 168 sq.ft. of ¾-in. perf. plate; lower, 8 ft.x 38; 224 sq.ft. stainless-steel ⅛-in. perf. plate; 6-in. stroke	156	1	30 (e)	860	V-belts
Washed-coal (4x1¼-in.) crusher, 36x48 in., double roll	1,020 (a)	1	40	690	V-belts
Hydroseparator, 29-ft. dia., 6,300 g.p.m.	3	1	5 (e)	860	Worm-gear reducer
Boot overflow pump	....	1	5 (e)	860	Direct
Elev., ⅛-in.x 28-in. coal, 43½ ft. c. to c., about 70 deg.	100	1	15	1,155	Roller chain and single-red. (3.74:1) herringbone reducer
Two two-tray fine-coal dewatering screens, 160 sq.ft., ½-mm. wedge wire, 1¼-in. stroke	300	1	10	1,150	Silent chain
Dryer feed conv., 30x8 in., 38½ ft. c. to c.	74½	1	5	1,155	Roller-chain and double-red. (21.41:1) herringbone reducer
Centrifugal dryers	....	3	50	1,155	V-belts
Dried-coal conv., 24x8 in., 61 ft. hor., c. to c.	120	1	20	1,115	Roller chain and double-red. (25.40:1) herringbone reducer
Clean-coal transfer belt (b), 36 in., 162½ hor., c. to c., 32 ft. lift	306	1	20	1,155	Roller chain and single-red. (6.38:1) herringbone reducer
River belt (b)	....	1	10	870	V-belts
Circulating-water pumps, 8,500 g.p.m., 60-ft. head, –28-m. coal	....	2	100(e,f)	3,500	Direct
Froth-breaking pump, 160 g.p.m., 50 to 60 lb. through ¾-in. nozzle	....	1	15 (e)	3,500	Direct
Pit drainage pump, 25 g.p.m., 20-ft. head	....	1	¾ (e)	1,125	Direct
Slurry (35 per cent solids) pump, 250 g.p.m., 61-ft. head	....	1	15 (e)	875	Direct
Filter (–28 mesh)	....	1	3	1,165	Roller chain and variable (4:1) speed drive
Vacuum pump, 2,382 c.f.m.	250	1	100 (f)	....	V-belts
Filtrate pump	....	1	7½ (e)	1,745	Direct
Positive-pressure blower	....	1	3	1,165	V-belts
Filter-cake conv., 18x6-in., 28 ft. c. to c.	58	1	3	1,165	Roller chain and double-red. (30:1) herringbone reducer
Fresh-water pump, 150 g.p.m., 125-ft. head	....	1	10 (e)	3,470	Direct
Samplers	....	3	1/2	1,725	.....
Stoker	....	1	2	1,740	.....
Unit heaters	....	4	1/6	1,140	Direct
		5	1/2	1,140	Direct
Utility compressor	....	1	25	1,150	V-belt
Slate-bin gate	....	1	3	1,730	Gearmotor (86.3:1)
Batch-hopper gates	....	2	2	1,740	Worm reducers (48:1)
Aerial tramway	....	1	75 (f)	860	Reducer (21:1)
Emergency larry-loading conveyor	....	1	30	1,150	Gears
Dust-collecting fan	....	1	40	1,170	V-belts

(a) Feet per minute at tips of teeth. (b) Six plies, 28-oz. duck, 1/8-in. rubber cover on carrying side, 1/16-in. on pulley side; belt-training idlers are installed at about 100-ft. intervals. (c) Traveling speed on track across bin top. (d) Totally inclosed. (e) Splashproof or drip-proof. (f) 2,200 volts.

Hoods Keep Down Dust

To keep down the liberation of dust in the plant, hoods are installed over and under the scalping screen, at the discharge ends of conveyors handling raw coal and at other points where dust may be thrown into the air. These hoods are connected by ducts to an exhauster, which feeds a cyclone dust collecter.

The Isabella preparation plant is operated by 70 ball-bearing motors ranging in size from 1/6 to 100 hp. This total includes four motors used in the operation of the aerial-tramway refuse-disposal system, but excludes the motor on the slope belt and a few small special-purpose units. All motors 50 hp. or less in size operate at 440 volts, with the larger motors at 2,200 volts. Outside of worm-gear reducers and silent-chain units, drives primarily consist of single- or double-reduction herringbone reducers with finished roller chains and couplings, supplemented by V-belts on screens, crushers and similar equipment.

Power to operate the 440-volt motors is stepped down from 2,300 volts by a separate transformer station. Magnetic starters are used throughout, and all 440-volt starters are grouped on a panel on the washing floor. On this same panel are mounted the circuit breakers employed in every 440-volt circuit. All wiring is placed in rigid conduit, with the exception that the final connection is made with flexible conduit in the case of V-belt drives, etc., where sliding motor bases are used.

Control buttons are centralized on a panel facing the washing units, and the entire plant control is placed in the hands of the plant operators, who also operate the slope belt. A signal system and telephone connection with the bottom permit coordinating the activities of the dump and preparation plant. Provision also is made for locking all breakers open when repairing equipment, and each repair

man is provided with a lock for that purpose. Actual locking out of circuits is done by the plant operators, who are on duty even on idle days, but repair men must stay by to see that the operation actually is performed.

For control purposes, the plant is divided into two sections. One consists of all equipment from the bottom of the slope to the top of the blending bin, while the other takes in all equipment from the bottom of the blending bin to the river, excluding, of course, certain equipment operated only occasionally and also with provisions for cutting certain units needed only now and then out of each sequence. With these exceptions, all equipment can be started only in sequence in the two sections. For emergencies, stop buttons are located at convenient points around the plant. These buttons when pressed kill all the motors in any one section.

Refuse Disposal Improved

With the installation of the new plant, refuse disposal was improved and the cost reduced approximately two-thirds by the installation of a double reversible aerial tramway with two angle structures and two 250-ft.-high tail masts. Length of the tramway along the cables is 3,350 ft., with the first angle structure 500 ft. from the loading terminal and the next 1,900 ft. Elevation of one tail mast above the loading station is 390 ft.; the other, 365 ft. Dumping at 3,050 ft., capacity of the tramway is 65 tons per hour, making 14.18 trips at an average speed of 800 f.p.m. The tramway is fitted with a $1\frac{1}{8}$-in.-diameter locked-coil track cable and a $\frac{3}{4}$-in. 6x19 Lang-Lay high-strength traction cable.

The old refuse-disposal system was based on the use of a saddle-tank steam locomotive pulling one side- and one end-discharge larries, each with a capacity of 15 tons. This equipment has been retained for emergencies. In addition to its other disadvantages, the old equipment had about reached the limit of its ability to waste material on the ground available. With the tail masts in their present position, the aerial tramway makes available sufficient storage space to accommodate an estimated 2,700,000 tons of material, allowing 20 per cent for shrinkage due to burning. At the end of approximately fifteen years the tail masts will be swung over about 30 deg. to the north to provide space for fifteen years', or more, additional storage.

Tramway buckets, of the end-dump type, have a capacity of 108 cu.ft. At the instance of the Isabella management, alloy-steel shapes and plates were used in the construction of the buckets and hangers, cutting about 1,000 lb. off the weight of each. In this installation, the number of carriage wheels was increased to eight, giving a considerable increase in the length of the bearing on the track cable and thus reducing the sharpness of the cable bend while the buckets are traveling. Heat-treated alloy-steel pins, studs, forgings, etc., were specified for the carriages to reduce wear and breakage and thus cut maintenance. Two track-cable oiling tanks are attached to the tramway carriages, which also are fitted with anti-friction bearings, along with all curved saddles and traction-rope guide rollers. Roller bearings are used in the traction-rope guide sheaves.

Barge-loading station at Isabella.

This aerial tramway cut Isabella refuse-disposal cost approximately two-thirds.

One man on each shift fills and dispatches the buckets, and for this service ex-hoisting engineers were selected because of their familiarity with equipment of this class and their ability to inspect and lubricate. Buckets are loaded from a two-door alloy-steel batch-loading hopper mounted on springs so that automatic closing of the main slate-bin gate is accomplished when the hopper is filled. Electric eyes and limit switches are to be installed to automatically stop the buckets as they come into the loading terminal, provided the operator, as normally is the case, has not already begun deceleration in preparation for docking the bucket. The tramway is driven by a 75-hp. 2,200-volt motor. Estimated maximum requirements is 110 hp., while the average is 50.

ELECTRIFICATION

+ At Isabella Mine

THOROUGHGOING revision of the underground d.c. power and distribution system at the Isabella mine of the Weirton Coal Co. was an outstanding feature of the conversion of the operation in the fall of 1937 from hand loading, short-wall cutting and horse gathering to mechanical loading, track-mounted cutting and locomotive gathering. This revision started with changing the d.c. distribution voltage from 575 to 275 (at the busbars) for both safety and maintenance reasons, supplemented by the installation of completely portable Ignitron rectifiers underground. D.c. positives and returns either were rebuilt or added to keep voltage drop to a minimum, and complete sectionalizing was assured by the use of automatic breakers and sectionalizing switches, the breakers protecting complete sections and the switches permitting isolation of 1,000-ft. stretches of both trolley and feeder systems inside or between breakers.

Voltage-Drop Limited

Summed up, the new d.c. system is designed to limit voltage drop between substations and face to not more than 10 per cent, in addition to complete sectionalizing to confine interruptions to not more than one working section, thus permitting the remaining sections to continue in operation. The voltage drop mentioned above is based on substations not over 2,500 ft. from the working sections, in which case it is expected that the average drop will not exceed 7½ per cent, with 10 as the maximum. At present, the substations are the farthest away from the working sections they ever will be—a maximum of about 5,000 ft. At this distance, the maximum drop contemplated in one part of the mine was 15.8 per cent; in the other, 14.4 per cent. The distance gradually is being shortened as previously developed territory is being mined out, and the voltage drop is expected to come within the limits set up in the next two or three years.

Operates on Purchased Power

Isabella mine and surface power, as was the case before the change-over to mechanization, is purchased at 25,000 volts, three-phase, 60 cycles, from the West Penn Power Co. and originates in two distinct sources, thus tending to insure continuity of service. A bank of three 633-kva. transformers was installed by the power company to step the voltage down to 2,300 for the new operation. From these transformers, a 2,300-volt circuit is carried in conduit to the coal company's new distribution substation, in which is installed a seven-panel switchboard. One of the panels carries the power company's meter, while the other six control the a.c. circuits to the various surface and underground equipment groups, as follows: underground substations, preparation plant, ventilating fan, underground pumps, bottom and supply hoist, and the river pumps supplying fresh water to the town and fire system. The underground substations, however, operate on 4,000-volt a.c. power, and consequently three 400-kva. auto-transformers have been installed to step the 2,300-volt power up to 4,000 for distribution to the substations through non-metallic cables.

The 2,300-volt circuit to the preparation plant is carried by non-metallic three-conductor cable to an all-steel six-panel switchboard in a brick vault in the plant building. One panel controls the circuit to three 150-kva. transformers outside the building, which step the voltage down to 440 for operating the majority of the plant motors, and to two 25-kva. transformers which supply 110-volt current for general lighting. The other five panels control 2,300-volt circuits supplying the following: aerial tramway, vacuum-filter pump, the two wash-water circulating pumps and the slope belt.

The 2,300-volt circuit serving the bottom and the supply hoist is carried by non-metallic cable to three 100-kva. transformers which step the voltage down to 440 for the operation of equipment in this group. In installing the surface circuits, all pole lines have been, or are being, eliminated in favor of non-metallic cables.

Changes in Distribution Set-Up

The original underground d.c. distribution system was based on the use of three 200-kw. synchronous motor-generator sets on the surface near the hoisting shaft a little more than three miles from the farthest-in working section. These sets, nominally rated at 550 volts, had been

4000-volt circuits serving underground substations consist of non-metallic cables with junction boxes at approximately 1,000-ft. intervals.

stepped up to 600 at the time the change-over was made, and fed a distribution system consisting primarily of a 4/0 trolley wire supplemented by a 500,000-circ.mil feeder line to the primary parting; 250,000 circ.-mils to the secondary partings; a 4/0 trolley line to the butt entries; and two No. 4 wires (positive and negative) into the room necks for attaching cutting-machine and drill nips.

Old vs. New Demands

Aside from the 13-ton locomotives on the main line, 8-ton swing locomotives pulling from the secondary to the primary partings and a number of small pumps, underground equipment under the old system comprised shortwall cutting machines and hand-held electric coal drills. The surface load consisted primarily of the fan, equipped with a 300-hp. brush-shifting motor, a 400-hp. coal-hoist motor and the tipple and barge-loading station. A second hoist of the same size was used for house coal and slate and consequently was in actual operation only at intervals. Incidentally, as the mine is classed as gaseous and consequently only equipment approved by the Pennsylvania Secretary of Mines is permitted beyond fresh air, resistances set on the intake air were used with the drills, inasmuch as only 250-volt units were available in the permissible type.

Total mine demand (surface and underground) under the above conditions averaged 898 kw. in the three months preceding the change-over, of which about 70 per cent was chargeable to surface operation. Energy consumption averaged 4.615 kw.-hr. per ton.

Main haulage now is handled by one 13-ton trolley locomotive, which receives trips from three 8-ton swing locomotives. Six mechanical-loading units were set up to accomplish the face cycle, each loading unit consisting of a 25-hp. loading machine, 50-hp. track-mounted cutting machine, 2-hp. drill (primarily old units retained) and an 8-ton gathering locomotive. Pumping units have been reduced somewhat in number, although no change has been made in type or size, and the extra pumps are to be rebuilt for reserve service. However, a new borehole at what probably will be the low point in the mine is expected to reduce the power necessary for the main pumping operations.

The six mechanical loading units are an increase of one over the five in regular service in March, 1938, in which month the total plant demand averaged 1,290 kw., distributed as follows: preparation plant, 600; fan, 100; mine, 250; remainder (pumps, slope, etc.), 340. Energy consumption in that month was 7.40 kw.-hr. per ton, distributed as follows: river pumps serving preparation plant, 0.39; preparation plant, including aerial tramway and slope belt, 2.56; fan, 1.20; bottom and supply hoist, 0.15; a.c. mine pumps, 0.20; d.c., substations, 2.90. In view of the short period in which the new system has been in operation and the necessity for getting men accustomed to working with the new machinery, particularly at the face, output per mechanization unit still is in process of building up to the contemplated normal, at which time it is expected that energy consumption per ton will show a drop.

Maintenance a Voltage Factor

Aside from the reduction in hazard, the prime consideration in the adoption of 250 volts was lower maintenance. Design considerations also entered the picture inasmuch as inclosures on 550-volt equipment necessarily are larger than in the case of 250-volt units. At the same time, the management took cognizance of the fact that the lower voltage results as a rule in a better general design. In the case of the d.c. pumps, incidentally, all motors —old types and mixed sizes—were replaced with new-type reconditioned motors, although the old motors can still be used, if necessary, but at slower speed. In this operation, an attempt was made to standardize sizes as far as possible, with the result that 23 5-hp., two 7½-, two 15- and three 20-hp. units were purchased. The original 550-volt motors were removed, the pump bases were drilled for the new units, new 250-volt starting equipment was installed ready to connect, and the old motors were replaced in advance of the change-over, which was done at one swoop by a special crew.

Adoption of 250-volt d.c. equipment, of course, made an increase in copper size necessary, but this was compensated for to a large extent by keeping the substations close to the working face—a necessity in mechanized mining. To ease the problem of keeping the stations up, portable conversion units were adopted. One of the three portable units installed—at present at Fifth West (Fig. 1)—will be semi-permanent. The other two sets probably will remain at their present locations 2½ and three years, respectively, the longest probably that either will be in one place.

Isabella metering equipment. A graphic watt-hour meter was in use when this photo was taken and consequently is not shown.

Why Rectifiers Were Selected

Major considerations in the selection of rectifiers for d.c. conversion were ability to withstand heavy momentary peaks; higher efficiency, in the case of Ignitron type selected, than other types of conversion equipment; and lower anticipated maintenance cost of the conversion unit proper. Automatic control was installed to increase efficiency in addition to other considerations. Sectionalizing with automatically reclosing circuit breakers and the use of these breakers in the tie lines between substations was felt to be a necessity for two reasons: protection against fire in the case of a dead short in the d.c. system, and localization of trouble when it occurs in one area, thus permitting the others to work uninterruptedly.

Ignitron rectifiers employed at Isabella are 300-kw. units arranged with six tubes for 6-phase operation and nominally rated at 275 volts d.c. Over-all efficiency of the complete rectifier unit from the primary a.c. terminals to the d.c. bus, with the transformer connected to give the rated d.c. voltage and including auxiliary equipment losses but not the power for the blower and circulating water pump for the heat exchanger, is as follows: one-quarter load, 91.55 per cent; one-half, 93.15; three-quarters, 93.10; full, 92.75;

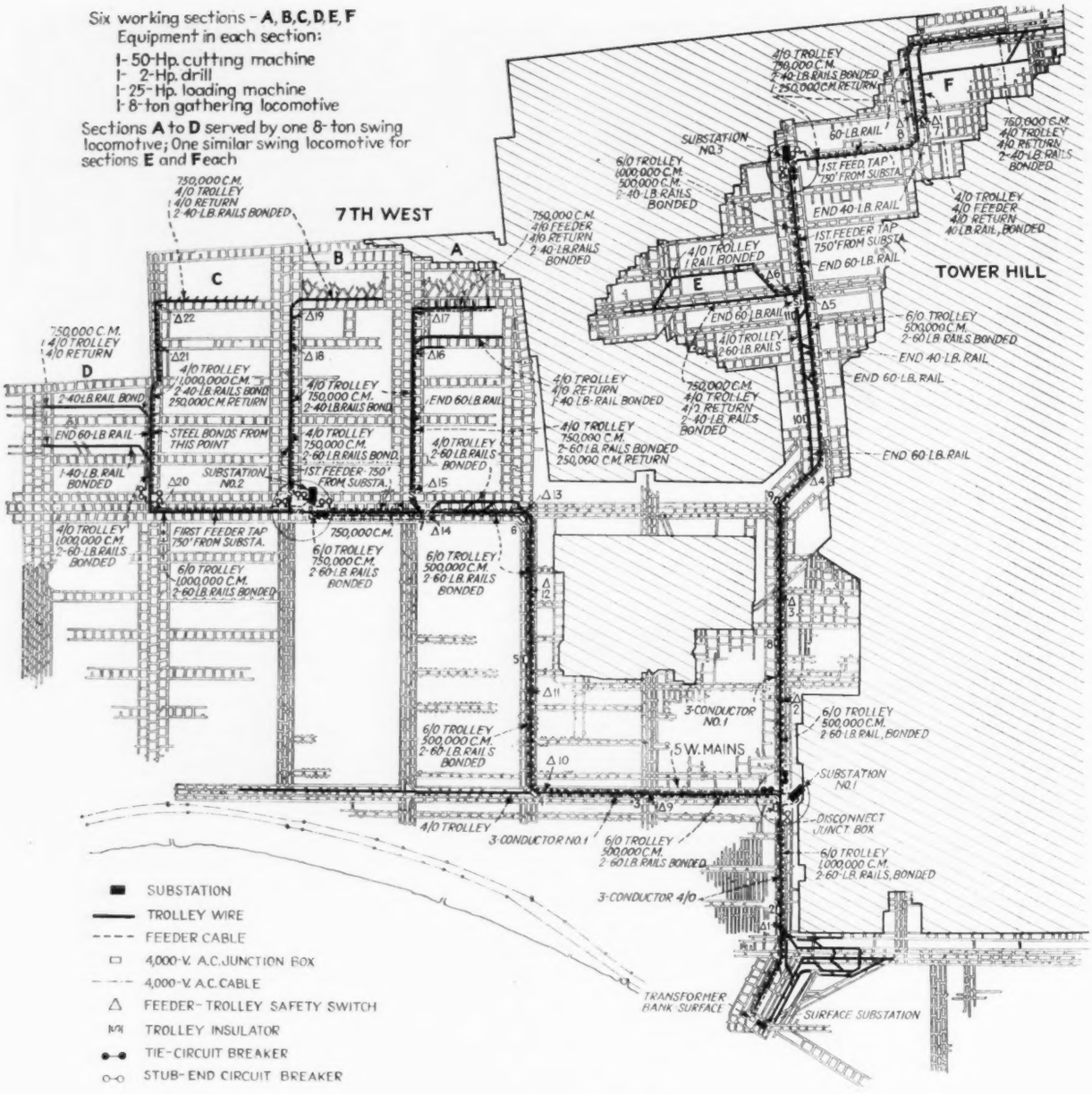


Fig. 1—Isabella mine workings, showing 4,000-volt circuits to substations, substation locations, d.c. circuits, use of automatic-reclosing sectionalizing circuit breakers, location of feeder and trolley safety switches, etc.

one and one-quarter, 92.30; and one and one-half, 91.80 per cent. A non-inflammable liquid-insulated self-cooled 346-kva. three-phase 60-cycle 4,085/264-volt transformer rated at 150 per cent full load for two hours is connected ahead of each rectifier. The transformer liquid, being non-inflammable, eliminates fire and explosion hazards.

An Isabella substation nominally consists of three equipment units, although a fourth is now present in two. Each unit is truck-mounted for maximum portability. The three normal units are: (1) transformers and a.c. switchgear and control transformers; (2) rectifier and heat exchanger; (3) d.c. switchgear and all relays and instruments. The fourth unit in two of the stations is a group of automatic reclosing sectionalizing circuit breakers.

Transformer weight is 12,700 lb., excluding switchgear, while the transformer truck has a weight of 1,200 lb. Dimensions of this unit are: length, 145 in.; width, 50⅝ in.; height above the rail, 60½ in. Weight of the rectifier unit is 3,500 lb., including the truck, and the dimensions are: length, 84 in.; width, 62 in.; height, 55 in. The d.c. switching unit is 80½ in. long, 56 in. wide, and 56 in. high. Circuit-breaker units are 96 in. long, 56 in. wide and 66 in. high to the tops of the breakers.

Present location of the substations is shown in Fig 1. No. 3 station serves two mechanical-loading units in the Tower Hill section of the mine, while No. 2 supplies four units in the Seventh West territory. No. 1 station, semi-permanent, is located at the main-haulage junction at Fifth West and supplies the bottom and the main haulage, in addition to helping out the other stations, as necessary. All three stations are tied together, with four breakers in the tie lines between No. 1 and No. 2 and between No. 1 and No. 3. Two of the breakers are located at the No. 1 station, with one each in the Nos. 2 and 3 stations. These breakers, rated at 1,000 amp., localize any

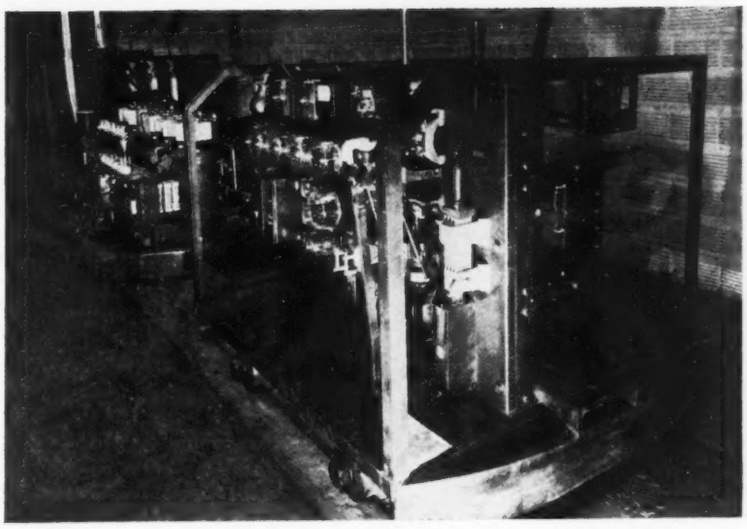
trouble between stations and enable them to continue in operation to serve other loads. The substations at the Isabella represent the first time a mine has been completely equipped with Ignitron rectifiers, and the first installation in which all are of the portable type.

A.c. power to operate the substations is stepped up from 2,300 to 4,100 volts by transformers on the surface, which feed the non-metallic cable system. Capacitor equipment is scheduled for installation on the surface to raise the power factor to 96.2 per cent. From the transformers down the shaft, the mine circuit consists of 400 ft. of steel-wire-armored cable with three 4/0 conductors and three ground wires having a total area equivalent to one conductor. From the shaft bottom to No. 1 substation, 2,150 ft., the circuit consists of a submarine-type rubber-covered acid- and alkali-proof cable with the same sized conductors and ground wires. From No. 1 to No. 3 substations, 7,050 ft., a similar cable is used, except that wire size is No. 1. The same applies to the circuit from No. 1 to No. 2 stations, 7,550 ft.

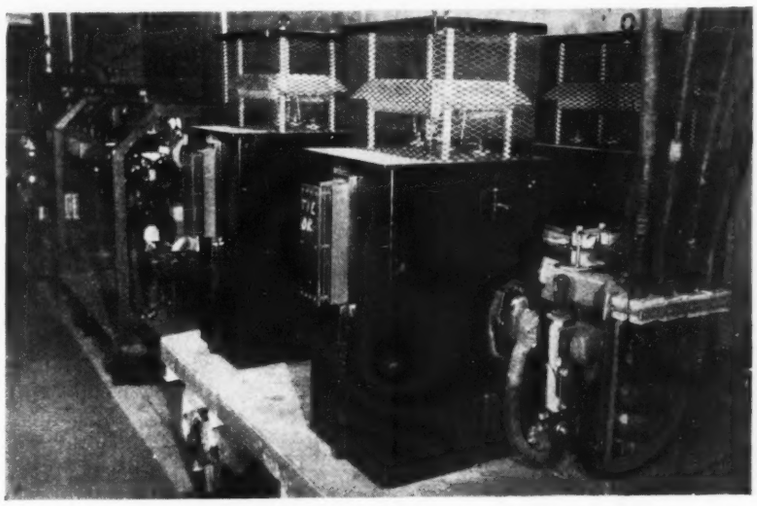
A.C. Drop 1 to 2½ Per Cent

Voltage drop from the transformers to No. 1 substation is slightly under 1 per cent; from No. 1 to the other stations, the drop is about 2½ per cent. The cables are laid in a trench at least 18 in. deep and are packed with clay, after which the trench is filled with non-inflammable material removed therefrom. These same trenches also carry the telephone lines. At intervals made necessary by limitations on handling the reels, junction boxes are mounted in brick-lined recesses in the rib, closed by steel doors. At Fifth West, the 4/0 circuit terminates in a switch-and-junction box, from which the No. 1 cables go out to Tower Hill and Seventh West.

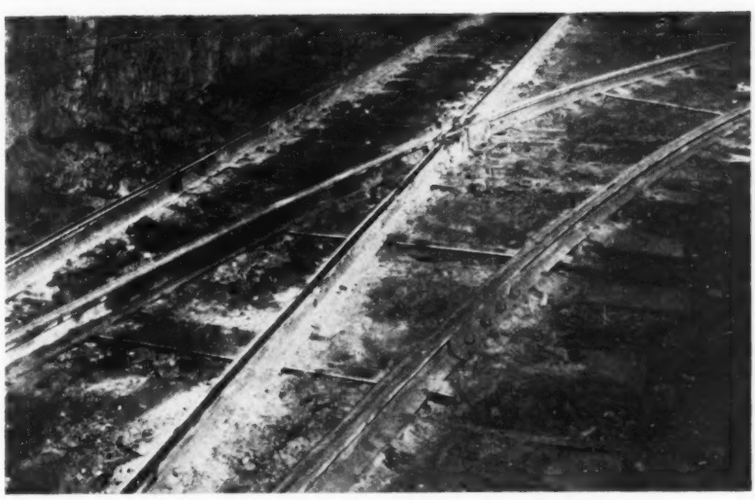
Fig. 1 shows the d.c. distribution system at Isabella, along with the 4,000-volt a.c. system and the location of feeder and trolley sectionalizing safety switches, trolley insulators and tie and stub-end circuit breakers. A 6/0 trolley wire paralleled by a 500,000-circ.mil feeder is installed along all main haulage roads, with the exception of the section between the bottom and No. 1 substation—1,000,000 circ.mils. From the substations into and about two-thirds up the butt entries, the positive line consists of a 4/0 trolley wire and a 750,000-circ.mil feeder. Actually, due to the use of rectifiers, the rails are positive in Isabella,



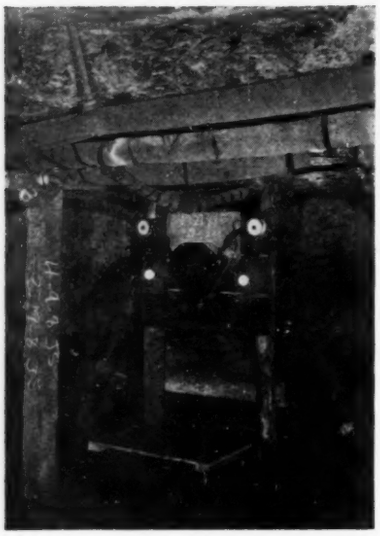
One of three portable substations used at Isabella. A.c. transformers and switching equipment are mounted on the rear truck. In the center is the rectifier with heat exchanger and auxiliary equipment. In front is the d.c. switching truck with all the necessary relays and instruments.



Automatic reclosing circuit breaker truck in No. 2 substation.



Cross rails are used as bonds on main-line track, as indicated in this view of a 60-lb. turnout.



Feeder and trolley safety switch, with indicating lights, in 36 North Face Entry.

while the trolley and feeder lines are negative. For the purposes of this article, however, the common nomenclature will be used. Instead of tapping into trolley lines at the substations, Isabella practice is to take the first tap off the feeder line 750 ft. away. Trolley lines are sectionalized for feeding purposes by the use of insulators at points shown in Fig. 1.

Returns at Isabella must have a copper equivalent area equal to the positives. On main lines, therefore, the return consists of two bonded 40- or 60-lb. rails—mostly the latter. Returns from the mouths of the butt entries consist of two bonded 60- or 40-lb. rails supplemented by a 250,000-circ.mil feeder line. Furthermore, the two bonded 40-lb. rails in the butt entries are supplemented by a 4/0 auxiliary return, primarily for the use of the loaders, cutters and drills. The method of installing this auxiliary return is shown in the illustration on p. 77.

With the exception of U-bolt steel bonds in one section, temporary and semi-permanent track is bonded with welded joint and cross bonds. Joint bonds are applied to the inside of the rails, with cross bonds around every switch and at approximately 150-ft. intervals on straight track. On main lines, however, the practice is to weld rails across beneath the track rails, these cross rails serving both as bonds and track stabilizers. Old 25- or 30-lb. rail is used for this purpose and a minimum of two cross rails are welded between each track joint, by which is meant a joint on one rail and the next joint on the opposite rail. Turnout practice is illustrated in a photograph reproduced on p. 75.

In accordance with the latest recommended practice, sectionalizing at Isabella is arranged so that each mechanical-loading section is separated from all others, with an automatic reclosing breaker in each section circuit to reduce the fire hazard in case of a dead short and also confine any trouble to that section alone. At No. 1 substation, for example, in addition to the two tie breakers noted above, a 1,000-amp. breaker is inserted in the feeder circuit to the bottom. At the No. 3 substation, in addition to the tie breaker, the two working sections (K-Flat and M-Right) are protected by one breaker each, also 1,000-amp. units. All breakers at No. 3 are mounted on a truck located in the substation, as the use of separate circuits to each section—facilitated by the mine layout—and the relatively short distance to the sections made the substation the logical location for the section breakers as well as the tie unit. At No. 1 substation, however, the breakers are permanently located in outside stations, one of which is shown in an accompanying picture.

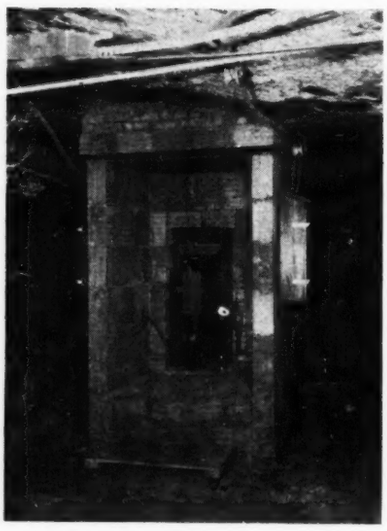
Complete Sectionalizing Followed

For the same reasons cited above, four of the breakers at No. 2 substation, including the tie unit, are mounted on a truck in the station. One of the three section breakers, however, backs up two subsidiary breakers in 44 North face entry, the subsidiary breakers protecting their respective working sections and at the same time, with the back-up breaker, guarding against trouble in the circuit between the substation and 44 North. This method also follows recommended practice for branching circuits. None of the breakers, all identical in type and rating, is used to limit demand.

In addition to the automatic breakers, which might be said to do an over-all job, all trolley and feeder circuits are sectionalized at approximately 1,000-ft. intervals by means of sectionalizing safety switches, which can be operated under load. One objective was the elimination of the usual knife- and trolley-type sectionalizing switches and the hazard inherent in their use.

The safety switches are installed substantially as shown in an accompanying illustration, and both trolley and feeder lines are carried into them, a dead block being used in the trolley to permit breaking it up into sections. Indicating lights mounted on the switch support facilitate trouble shooting. In the case of a dead short in a stub-end circuit serving a working section, for instance, the automatic breaker would go out and a bridge resistance would be thrown across the terminals so that a low current would continue to be fed to the circuit and the indicating lights would burn dimly. Then, starting at the face, the electrician would open each switch in turn until the one out by the short was reached, by which time the trouble usually would be located. Opening this switch would cut the short off the line and allow the breaker to close, with the result that one light would burn at full brightness, indicating everything clear back to the substation, while the other, of course, would go out. But if, as might happen, trouble should occur at two points, the one light would stay dim, indicating the need for further investigation. Upon completion of repairs, the switches would be closed on the way back in to restore service. With the necessary modifications, the same principle is employed in isolating trouble in lines between substations.

Tie-breaker installation outside No. 1 substation.



SAFETY

+ At Isabella Mine

THE TREND of injury occurrence at the Isabella mine of the Weirton Coal Co. offers striking confirmation of two general conclusions held by many safety authorities. One is that education is a necessary element in securing the cooperation of employees, without which safety progress cannot be made, even though excellent physical safeguards are the rule. The second is that mechanization of loading and other underground operations actually may result in an improvement in the injury record, primarily through better supervision and training of men.

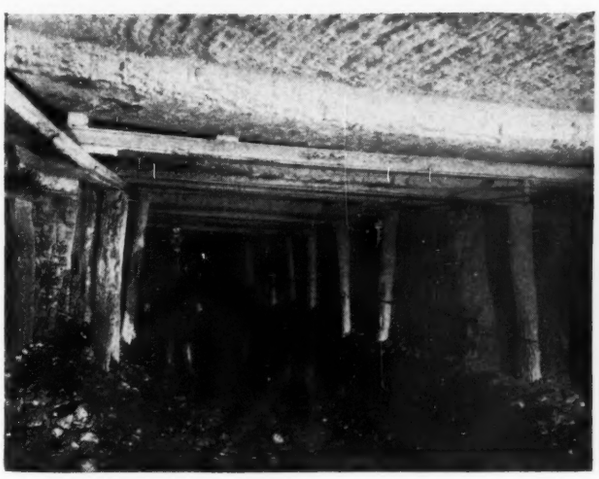
Isabella mine was converted from hand loading and horse haulage to mechanical loading and locomotive gathering in November, 1937, while on the surface a modern blending and washing plant was installed together with a belt slope. Conforming with the other changes at the operation, a safety engineer was added to the staff and an educational program was given the unreserved support of the management.

Results of the above changes may be measured from the safety standpoint by comparing the record for the period from Oct. 1, 1937, to March 31, 1938, inclusive, with the previous six-months' period (April 1-Sept. 30, 1937). Number of injuries reported was reduced 32.3 per cent; lost-time injuries, 63.4 per cent; compensable injuries, 78.2 per cent; frequency rate, 56 per cent; severity rate, 36.8 per cent; total cost of all injuries, 28.7 per cent.

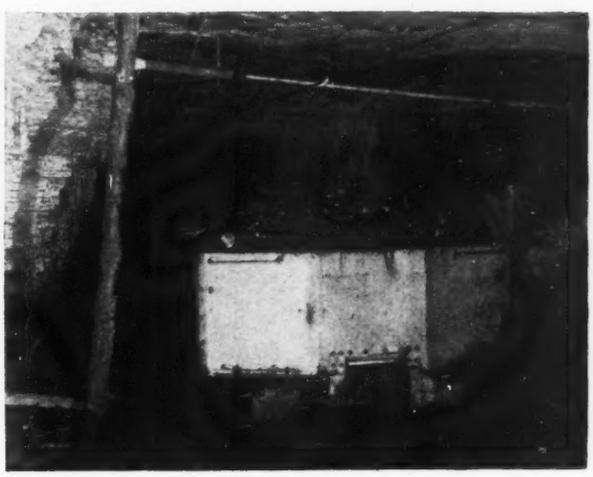
Isabella mine is classed as gaseous, and consequently the rule that no equipment except that approved by the Pennsylvania Secretary of Mines can be used beyond fresh air has been in effect at the operation for some years. Furthermore, electric cap lamps were in use. Entries were rock-dusted by machine and working places were hand dusted. Goggles were supposedly worn when necessary, and the mine was practically 100 per cent on safety hats and shoes. All in all, the operation prior to the inauguration of the modernization program detailed in the other articles in this issue was perhaps a bit better than the average mine from the standpoint of physical conditions, although possibly not equipped to carry on a well-organized program for educating employees and enlisting their cooperation.

But even from the physical standpoint, striking advances have been made in the course of the modernization program. In fact, safety was classed as equally important with other objectives in equipment design and mine and plant layout. In the preparation plant, for example, design for safety was carried to the point where only two unavoidable low places exist in the entire operation. Steel and concrete were used through-

Rock-dusting of all working places is a regular week-end activity. The whitest possible dust is used to improve mine visibility.



Sprinkling station at a main-line parting. Note footboards and handrails on car corners; also "cat eyes" under handrails.



out and 2,300-volt switching and control equipment was housed in a brick vault. All belts, gears and other moving parts and machinery either were inclosed in metal guards or fenced off, and all walkways, stairways and platforms were equipped with handrails.

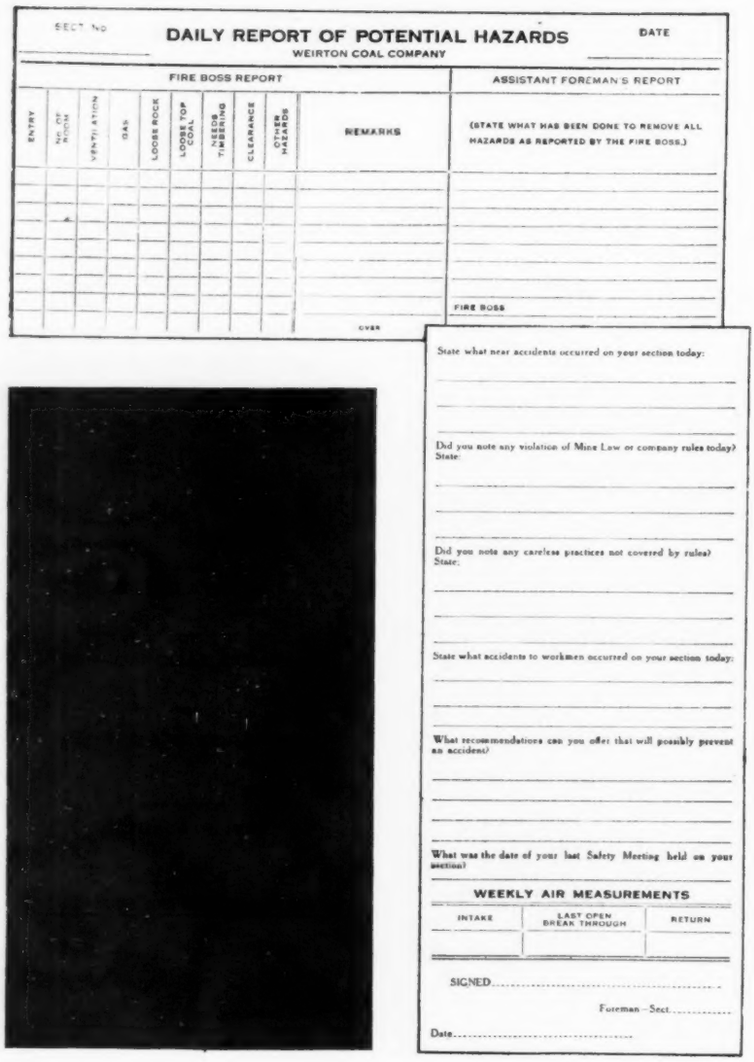
Similar guarding and protection is the rule in other surface buildings and structures. In addition, overhead pole lines have been, or are being, replaced with non-metallic cables buried underground and a good housekeeping program is actively in force.

Guarding as required and good housekeeping are held equally important underground, but safety in the mine at Isabella might be said to start with provisions for routing employees to man-trips. Entrance to the mine is by a slope in which also is located the main slope belt and the material track. Men, however, use concrete stairs with 6-in. risers and 24-in. treads for easy walking, separated from the conveyor on one side by a guard rail and from the material track on the other by a 5-ft.-high concrete wall equipped with light standards at intervals. Once they enter the slope, men ultimately will not be required to cross a track in going to the waiting room and man-trip loading stations. This is accomplished by bridges over the tracks, the last of which is scheduled for immediate installation. These bridges and the waiting room and man-trip loading stations are shown in Fig. 2, p. 59.

Making up, dispatching and operation of man-trips are strictly regulated and responsibility for these activities is definitely placed to make sure that they are properly carried out. Men are transported in the wooden cars previously used for hauling coal. These cars, however, have been modified to fit them for this service, including building up one side against the wire and the front end against the wind, while the opposite end of each car has been removed entirely and suitable level seats built. End cars in man trips are equipped with the automatic couplers used on the coal cars and also are fitted with brakes. When men leave the trips inside the mine they are at the tool boxes in their sections.

The slope, after removal of the old timber and material broken loose from the top and sides, was gunited for permanent protection against falls. The same practice is followed in all bottom openings and on all permanent haulage roads, except where good sandstone top is present. In fact, a major objective is the elimination of legs wherever possible throughout the mine. Where guniting has not been, or is not to be, done, this objective is accomplished by placing crossbars in holes made with a hitch drill or on stringers resting on pins in hitch-drill holes (see article beginning on p. 57), this in semi-permanent openings. In butt headings and working places, particularly the former, the top cut is extended over into one rib to make a hitch in which one end of the bar rests, leaving only the other to be supported on a post.

Fig. 1—Showing the cover of one of the Isabella rule books and, top and at right, the front and back of the duplicate "Daily Report of Potential Hazards."



SECT. NO. DAILY REPORT OF POTENTIAL HAZARDS DATE
WEIRTON COAL COMPANY

FIRE BOSS REPORT										ASSISTANT FOREMAN'S REPORT
ENTRY	NO. OF ROOM	VENTILATION	GAS	LOOSE ROCK	LOOSE TOP COAL	NEEDS TIMBERING	CLEARANCE	OTHER HAZARDS	REMARKS	(STATE WHAT HAS BEEN DONE TO REMOVE ALL HAZARDS AS REPORTED BY THE FIRE BOSS.)

OVER

FIRE BOSS

State what near accidents occurred on your section today:

Did you note any violation of Mine Law or company rules today? State:

Did you note any careless practices not covered by rules? State:

State what accidents to workmen occurred on your section today:

What recommendations can you offer that will possibly prevent an accident?

What was the date of your last Safety Meeting held on your section?

WEEKLY AIR MEASUREMENTS

INTAKE	LAST OPEN BREAK THROUGH	RETURN

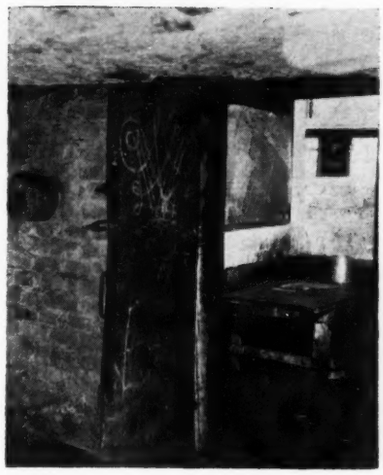
SIGNED.....

Foreman—Sect.....

Date.....

Steel Replaces Wood

Round wood crossbars are being eliminated in favor of steel-rail bars, except for some experimental 4x10-in. sawed units in working places. Standard minimum post diameter is now 6 in. Two bars per cut are the standard in working places (Fig. 4, p. 55). Axes have been taken out of the timbermen's tool kits and only sawed cap pieces are employed. Timbermen, trackmen and drillers are supplied with push trucks to reduce heavy lifting and carrying of equipment and supplies. Drill trucks are equipped with permissible cable reels. Timbermen are supplied with special jacks to help them handle the bars, while tracklayers are furnished with light-weight aluminum-alloy rail benders, punches, etc. Clearance is another important consideration at Isabella; in fact so important that bosses and men are furnished with blueprints showing how places shall be turned and cut, track shall be laid and timbers shall be set to insure preservation of this clearance. Furthermore, the



Showing stretcher canister and (inside the office) the portable first-aid kit provided the section foreman.

idea of distributing standard working plans has been extended to all other tasks which lend themselves to this educational method, and has been found a valuable means of insuring safe physical conditions and operating practices.

Specifications call for a minimum clearange of 30 in. between the widest piece of equipment and the timbers, wall or rib on the left-hand side of all places and 12 in. on the right. With the installation of the new and wider mine cars, less than minimum clearance prevailed in certain places. These places were cut back with the track-mounted cutters, using the bar in side-shearing position, which was found a quick and convenient method of accomplishing this objective. Manholes every 45 ft. not over 4 ft. wide, at least 4 ft. deep and not less than 5 ft. high, are the rule, and here also the track-mounted cutter has been found a time- and money-saving piece of equipment. All equipment is designed for left-hand operation, including car brakes, etc., so that men need not get on the tight, trolley-wire side.

Guard Rails Eliminated

Shrouded frogs make guard rails unnecessary on main and secondary haulage roads. Every turnout is equipped with a low-type parallel throw. Except where timbers or other conditions prevent, the trolley wire is installed 6½ ft. above the track-rail. Where the wire must be placed lower, wooden guards are employed as a rule, with preformed rubber guards at points where there is a possibility that they will be struck and torn off or loosened.

All wire and feeder circuits are sectionalized as described in the article beginning on p. 72 to prevent fires in case of dead shorts and also facilitate safe repairs. Trolley and feeder safety sectionalizing switches are mounted in crosscuts away from the track, with asbestos-compound sheets over and above them to prevent flame from igniting timber or coal. These switches may be opened safely when the power is on, and in fact one of the major objectives in the installation of these and the automatic breakers was the elimination of all trolley and open-type knife switches. Junction boxes in the 4,000-volt a.c. lines serving the substations are placed in brick cubicles with steel doors. Substation equipment is housed in brick, tile and concrete rooms, with automatic reclosing sectionalizing breakers and similar equipment outside substations in tile cubicles. Insulated platforms or rubber mats are placed in front of all switches. Transformers filled with a non-inflammable liquid are used in all substations, which also are equipped with a CO_2 extinguisher and a shelf containing three bags of rock dust.

Fused Trolley Taps Used

Fused trolley taps are used on all trailing cables. Stub lines are run into room necks to eliminate stringing cables across headings. All lights are attached to trolley lines or feeders with special clamps.

Provisions for the safety of the operators considered in the purchase of the new equipment involved in the modernization program included: safe and comfortable seats for snappers on cable-reel locomotives and operators on cutting machines; footboards on loading machines for the operator to stand on when tramming, these footboards also serving as guards; steps and handrails on each corner of all mine cars; aluminum paint and red reflector buttons, or "cat eyes," on mine cars to increase visibility; automatic couplers, etc.

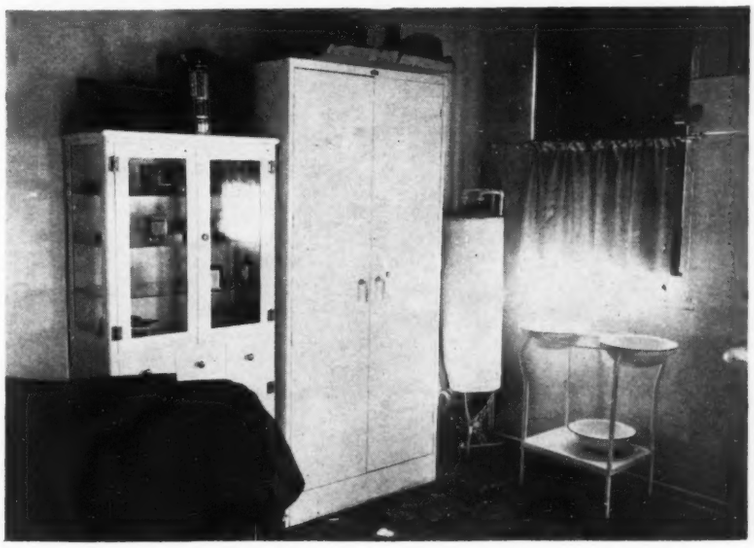
Explosives are transported in special insulated powder cars with insulated couplings, and explosives and caps are stored in special stations in back headings, as detailed on p. 92 of this issue. Protected caps are employed exclusively, and as an additional safeguard are carried in a special pocketed belt inside a heavy leather cap bag, which is kept locked. All shots are loaded and fired in a "permissible" manner, using sand-filled dummies and permissible single-shot firing units.

Rock-Dusting Done Weekly

Rock-dusting is a regular week-end event, using a high-pressure machine, and is carried up to the faces of the working places. One of the first considerations in the purchase of dust is whiteness to aid in illumination. Regular sprinkling of the coal and cars is another late safety practice. All cutting machines are equipped with water tanks and the bugdust is sprayed as it is made in the cut. Incidentally, the rear ends of the tanks are designed so that it is impossible for a man to ride on them. Loaded cars are sprayed on the main partings as they start for the bottom and again before they go into the dump. Finally, empties are sprayed after dumping.

With the addition of a safety en-

Part of the equipment in the surface first-aid receiving station at Isabella.



gineer to the staff, educational work got under way late in 1937. Meetings have been found the best method of achieving this end, these meetings serving to keep safety before both supervisors and employees and also as forums for the discussion and adoption of safety rules. Recognizing the importance of the supervisors, regular meetings are scheduled for this group. Every first and third Saturday in each month, department heads get together to go over operating and safety questions. Weekly foremen's meetings are held to discuss operating problems, methods and standards, with one session each month given over to injury prevention and the elimination of hazardous conditions and practices. And finally, department heads and bosses meet at quarterly banquets, at which safety is the major theme.

Monthly Meetings Held

Meetings of employees, usually with their immediate supervisor, are held once each month. The town-meeting type of get-together is avoided, the management rather preferring the small-group sessions noted above, at which there is a better opportunity for all participants to have their say. In the case of underground men, such meetings are held in the working sections, with the bosses presiding. As a rule, one order of business is reading and discussion of one of the weekly safety bulletins sent to every supervisor. This particular bulletin is designed for such use, whereas the others are prepared primarily for the supervisors. After the bulletin is discussed, groups then turn to injuries and hazards, and their prevention. The necessity for presiding at these meetings is another strong incentive for supervisors to interest themselves in safety work and perfect their ability to stop injuries.

Safety rules at Isabella are prepared for each separate class of mine employees and printed in separate bulletins for distribution. A tentative draft of rules in each case is prepared by the department heads. They then are explained at a meeting of the employees to whom they apply, at which time suggestions are solicited and the views of the men are obtained, all with the objective of securing voluntary acceptance of the rules and consequently improving the chances of their future observance. All rule books include such working drawings as may be necessary for both efficient and safe working.

A major factor in injury reduction at Isabella has been the introduction of a system of reporting and removing potential hazards, based on the "Daily Report of Potential Hazards" shown in Fig. 1. This report consists of a self-carboned original and a yellow duplicate, the duplicate containing on the back a series of questions as to safety conditions in each section. The report forms are carried by the firebosses, who fill them out and leave the originals with the assistant foremen in charge of each section. The duplicates are kept by the firebosses, who check, on their next round, what has been done by the assistant foremen to remove the hazards noted. Foremen, consequently, must keep on their toes. Firebosses and all other supervisors naturally have the authority to "danger off" hazardous places, and for this purpose are provided with special signs.

Great stress is laid on reporting all injuries at once, no matter how slight, and to facilitate discovery of injuries a "Yes-and-No" time clock is employed and is hooked up with an audible signal to inform the lamp man in case a man answers "Yes" to the question as to whether he has suffered any injuries on the shift he has just completed. A complete first-aid receiving station is maintained on the surface, and all assistant foremen are supplied with portable first-aid kits, which they keep handy in their sections, along with a stretcher and blanket and other first-aid material.

Protective Clothing Promoted

As indicated above, Isabella has been 100 per cent hard hats and safety shoes for a considerable time. Goggle use, however, has shown a noticeable increase in late months, and every man is supplied with a pair for use when he is doing work necessitating eye protection. Wire-screen goggles are no longer allowed. Electric cap lamps are used underground, with flame safety lamps for firebosses, foremen, cutters, drillers, shotfirers, loader operators and others required to test for gas. Protective clothing stocked at the Isabella store of the Oak Hill Supply Co. includes: safety caps, goggles, miners' and electricians' type shoes, rubber pacs, and high-topped safety shoes. Effort is being put forth to get cutters, haulage men and others around moving equipment to wear high-topped shoes or leggings or to tie their socks outside their pants legs to minimize the hazard of catching their clothing.

Modernization at Isabella also included improvements to the town, which has a population of approximately 1,200, not all of whom, however, are employees of the coal company. The town comprises 133 dwellings, in addition to other structures, of which 94 are double and the rest single. House and town improvements included: new sidings of asbestos shingles; replacement of window and door trim, where necessary, and repainting; removal of all fences; elimination of pig pens, cow yards, chicken runs, etc.; installation of steps and concrete coal bins behind each house; rebuilding of porches and all other necessary house repairs; adoption of a thoroughgoing whitewashing schedule; rewir-

Looking down the main street in Isabella. House renovation included asbestos-shingle sidings, new steps, rebuilding porches, etc.

ing of all houses to take care of the increased load growing out of the use of many additional electrical appliances; and installation of outside meters and conduit by the power company.

All fire hydrants and stations were rebuilt or repaired and thirteen new plugs and three new hose-cart stations were installed. Town residents have organized the Isabella Volunteer Fire Department and have taken over and are renovating the basement of the community building for use as a club. Other civic activities have included organization of a Boy Scout troop and a baseball team.

Use of asbestos shingles for house sidings saves painting—a substantial item of expense—lessens the fire hazard, makes the houses a good deal tighter and keeps them cooler in summer and warmer in winter. Rewiring eliminated to a considerable degree the fire hazard growing out of overloading old circuits designed for lighting only.

MAINTENANCE

+ At Isabella Mine

THE KEYNOTE of maintenance and repair work at the Isabella mine of the Weirton Coal Co. can be best expressed perhaps by defining the two terms as they appear to the mine management. In the view of mine officials, maintenance covers things to be done to prevent a repair job, while repair work is viewed, in the absence of special circumstances and mitigating conditions, as a failure to do a good maintenance job.

The adoption of mechanical loading and preparation in the late fall of 1937, of course, has materially affected the maintenance and repair problems at Isabella. At a glance, it would appear that both, and particularly the latter, had been materially increased. But while there naturally was such an increase, the change-over afforded an opportunity for selecting certain types of equipment inherently less subject to wear and breakdown, of rebuilding the equipment retained to reduce repair costs, and of designing new equipment to eliminate as far as possible those characteristics which might run up the repair bill. In fact, a major feature of the Isabella modernization program was the adoption of design principles tending to cut down maintenance and repair work in connection with operating equipments.

Close Check-Up Maintained

This has been supplemented by providing, as required, the necessary facilities for repairs and by setting up a system of keeping track of all mining equipment in particular, and other equipment as necessary, to make sure both that it is properly maintained and that the cause of any breakdown can be definitely ascertained with the resultant time loss. Furthermore, maintenance and repair work is set up so that every machine is charged with the cost of work done on it, the idea back of the system as a whole being to localize all work as far as possible so that offending equipment can be picked out for the application of corrective measures.

Equipment operators at Isabella make out a report at the end of each shift, giving the number of cars loaded or hauled, places cut, drilled, etc., as the case may be, and listing all delays with their length and the reason therefor, as well as the condition of the machine and repairs thought to be necessary when it was left. A carbon of the report goes to the chief electrician on each shift, who lists all reported defects and makes arrangements to have them taken care of, while the original goes to the electrical engineer. From this original, delays are copied onto a file card, along with the reason, this form permitting the necessary summaries of delays and their statement in percentage of possible operating time.

In addition to checks every shift by the operators, face equipment is regularly inspected by competent members of the maintenance and repair staff. Locomotives and drills are not lubricated by their operators. Loading and cutting machines each have a few points to be lubricated by the operator during the shift. Other points are greased once a shift, once a day, once a week, or once a month, as required, by the mechanics who specialize in this type of work.

Law and Good Management

While the inspections noted above are required by the mine law, they are not a matter of legal duty with the Isabella management, which rather looks upon them as an essential factor in keeping equipment in efficient operating condition. Locomotive and drill inspections take place in the shop. In the case of locomotives, one man on the first shift and one on the third, with a helper if necessary, specialize in maintenance and repair of this type of equipment. Locomotives are numbered from 1 to 19, and the inspection schedule provides for examining a locomotive, in order, on the two turns each day. To keep track of inspections, a card is provided on which the date of inspection is entered. A copy is furnished the dispatcher, who has the duty of seeing that each locomotive, as its turn comes, is taken out of service for check. This is made possible without interfering with mine production by having extra cable-reel and main-line units on hand. Drill inspection and repair work are done

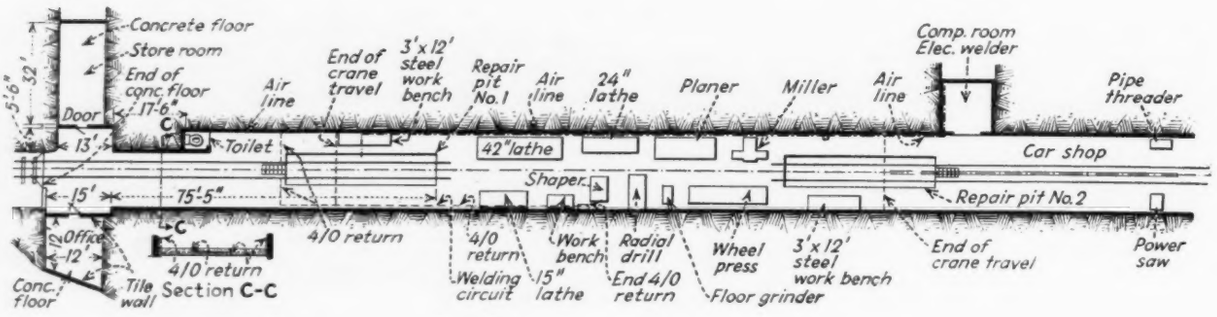


Fig. 1—Plan view of Isabella underground shop and auxiliary office and storeroom.

on the first shift each day, and a similar card is provided to facilitate keeping the record. Several extra drills, complete with push trucks and permissible cable reels, make it possible to exchange equipment for inspection.

Cutters and loaders, although checked, lubricated and repaired after each shift, are given a more thorough inspection on the idle day each week, which usually is Saturday. Regular maintenance crews are on duty each shift the mine operates, with sufficient rotating men so that on Saturday full crews are available for cutter and loader work. In the case of this equipment, the maintenance men check and repair the machines in the section in which they usually work. If the inspection takes place on Saturday, a skeleton crew goes in on Sunday, or in fact any idle day at the beginning of a new week's work, to complete any reported unfinished work and make sure that everything is ready to operate the next day. Machine operators have their own hand tools and either make or help make any minor repairs or adjustments if found necessary during their operating shift. However, nobody but electricians is allowed to break the seals and repair or adjust equipment or even replace fuses within the explosion-tested compartments.

Substations Inspected Weekly

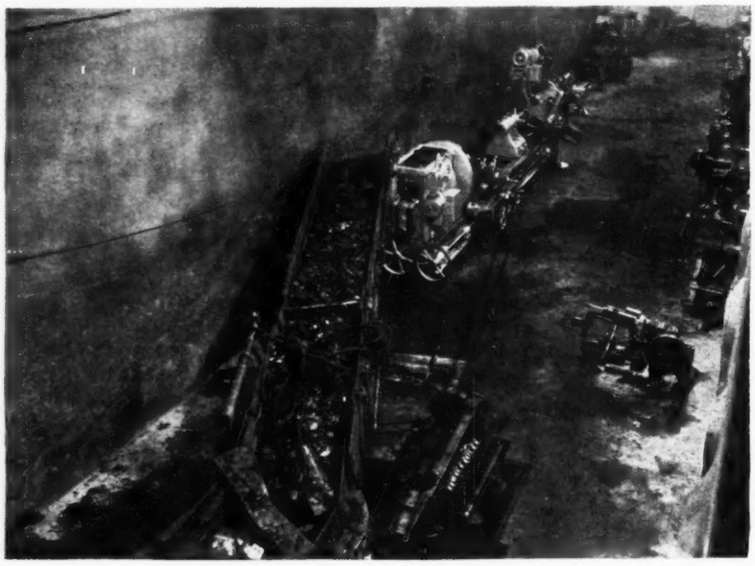
Substations are inspected once each week, at which time the equipment is cleaned. Wiremen and bonders take care of the 250-volt underground electrical circuits. On the surface, preparation-plant motors and equipment are under continuous inspection, starting at the rotary dump, by the plant force, which also does 90 per cent of the necessary repair work. Maintenance as a whole is under the jurisdiction of the electrical engineer, with a chief electrician on each of the three shifts handling the underground work, and the master mechanic, who also is the outside foreman, handling the bulk of the surface work.

Individual time sheets for each shift are furnished mechanics and electricians, on which they describe the work done, enter time required and list all material used. These reports are filed at the end of the shift with the electrical engineer, in whose office the information is transferred to file cards on which the cost of material and labor for each machine is kept. These cards enable the management to obtain the actual cost of maintenance and repairs either for a machine as a whole or any of its component parts. Periodic overhauling then is based on the tons produced. On loaders, for example, this figure is 50,000 to 60,000 tons. Experience data are not available for the track-mounted cutters, but the total is expected to be about the same.

Very little repair work, on the basis of the Isabella definition, is done back in the mine, activities at the face being confined largely to maintenance, including inspection, lubrication, cleaning, etc. When repairs, except those of a minor nature, are necessary, they are performed on the bottom in a new underground shop. This shop was made from an old stable, the stall partitions being removed and the old brick-and-tile walls extended to 12 ft. in height and gunited. Caved material up to about 30 ft. was removed, and the strata above the walls was covered with 4 in. of double-reinforced gunite. General arrangement and dimensions of the shop are shown in Fig. 1. Included in the shop proper, into which track-mounted equipment can be taken from either end, are two 35-ft.-long water-tight pits 5 ft. deep arranged for recessed lighting. Combination mazda-mercury vapor lights are used for general illumination, and compressed-air lines are run along the walls at the floor level.

Machine-tool and other equipment includes the following: 10-ton overhead crane; 42-, 24- and 15-in. lathes; 42-in. radial drill, 16-in. shaper, 24-in. planer, milling machine, 200-ton wheel press, pipe-and-bolt threading machine, power saw,

Where Isabella repair work centers—new underground mine shop.



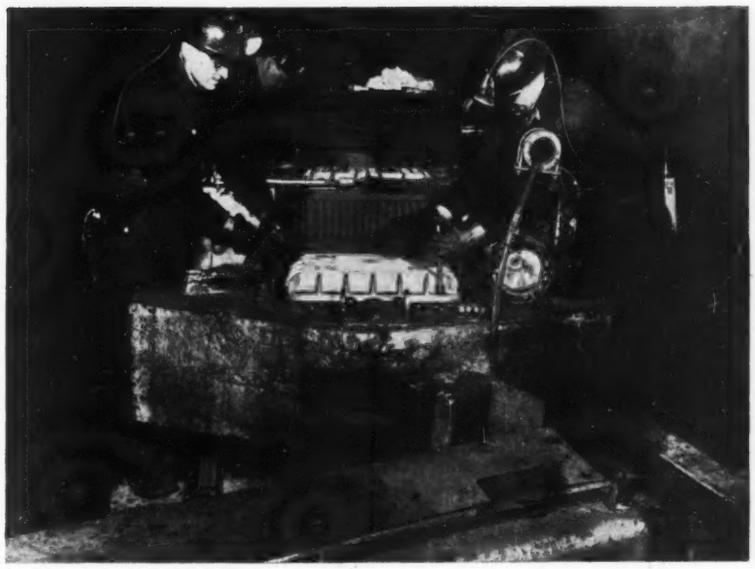
pedestal grinder, bench grinder, bench drill, one 400-amp. a.c.-d.c. welder and one compressor. Individual motor drives are provided for all machines, using 440-volt motors throughout with the exception of a variable-speed d.c. motor on the 42-in. lathe. Each motor has its own starter, controlled from a 14-circuit circuit-breaker panel.

Outside one end of the shop is an office and across from it a supply room. At the opposite end, just beyond the pit, is a room for the welder and compressor. Still further beyond is a separate car-repair shop equipped with, among other things, a 2-ton monorail electric hoist.

Repair-prevention or elimination measures at Isabella include a variety of both general and specific steps. The preparation plant, as in the case of all other equipment above and below ground, was fitted with anti-friction bearings as far as possible and provision was made for grease-gun lubrication. (Other measures for reducing preparation-plant repair work are detailed in the article beginning on p. 63.) In fact, a major objective throughout the entire operation was a reduction in frequency of lubrication, accomplished either by the use of lubricated-for-life bearings, as on mine-car wheels, or in the use of pressure fittings with as much lubricant-storage capacity as possible. Button-type pressure fittings are used almost exclusively. Motor bearings have plugs instead of regular fittings to avoid overlubrication.

Voltage Change Helped

In the case of the underground workings, a major step was changing d.c. distribution voltage from 550 to 250 (nominal), which reduced corrosion and maintenance of the inclosed controls on the permissible or explosion-proof mining equipment. Nitrous-oxide formation in inclosures presents the most serious problem on gathering and swing locomotives, due to the frequency with which the controls are operated. Such corrosion, however, has been eliminated and repair work materially reduced by installing inside each controller case a high-speed ventilating fan and labyrinth-type explosion-tested air inlets and outlets. This motor drives a vacuum-cleaner-type fan and runs continuously as long as the trolley or cable is connected. Fan-motor size is 1/50 hp., and it operates on approximately 80 volts. Motor life is about two years, and the cost is about $6.50 each. Without the fans it would be necessary to go into the controller case about every two days.



Regular equipment inspections are the rule at Isabella. Here one of the new 8-ton cable-reel locomotives is receiving its regular weekly check.

The brake rigging on the cable-reel locomotives was designed with an adjustment so that a much thicker tire than usual could be installed, thus permitting two cuts to be taken off, giving three wears before it is necessary to discard the tires. Gearless reels have been found to require less repairs, in addition to being easier on trailing cables. A minimum tension of 60 lb. is maintained on the cables, and is checked regularly by the use of scales. Clearances on inclosing cases on locomotives as well as all other equipment used at the coal face is kept under 3/1,000 in. Trolley shoes are installed on all locomotives to improve current-collecting characteristics, and trolley wires are regularly lubricated. Locomotives are greased once a week, but some parts require lubrication only once a month, while motor bearings are greased every three months.

All main-line locomotives were completely rebuilt and modernized when the voltage was changed over, including the installation of roller journal bearings and line contactors. On loading machines, the original road clutch was replaced with an all-steel clutch, the first such unit giving three months of service without being touched, compared with about fifteen to sixteen shifts for the original type. Drill operation was improved by putting on a heavier cable.

Mine cars were designed with lubricated-for-life ball bearings, heavy-duty cast-steel wheels, copper-bearings sheets, spring mounting, equalizing trucks, spring- and friction-type draft gear and heavy center and side sills and cross members, in addition to an angle welded around the top edges. Heat-treated and annealed alloy-steel shafts, axles, etc., are used, where experience has shown a necessity, on all underground mining equipment, along with tool-steel gears and pinions.

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Notes...FROM ACROSS THE SEA

GALLIUM and germanium, both rare metals, are found in coal, and gallium, at least, may be obtained with profit. Gallium is regarded by chemists as one of the "rare earths" and, possibly because of its high cost, has had little application in technique and industry, being used only in the quartz thermometer, reading up to 932 to 1,832 deg. F., and in vapor arc lamps, where it serves as substitute for mercury, which metal it excels in spectrum range. Like steel, it is a grayish metal; it melts at 86 deg. F., well below blood temperature, when it resembles tin or silver. It foils at 3,092 deg. F., making it well suited to high-temperature work. Its price hitherto has been about $36,000 a pound, or $80.66 a gram, and its source zinc blende.

Germanium also is grayish, has a conchoidal fracture and crystalline structure. It melts at about 1,652 deg. C., but some investigators have given higher values. So far, no uses have been found for it, but it aids hydrogenation of coal. Because it is so rare apparently no one has attempted to utilize it.

All gas-works dust, declared Sir G. Morgan and G. R. Davies, of the Chemical Research Laboratory, Teddington, England, contains both germanium and gallium; in addition may be found traces of silver, indium, thallium, cerium, lanthanum and occasionally vanadium, according to *Chemistry & Industry*. Flue dust is an unimportant source of these latter metals but a valuable potential source of germanium and gallium, and there is little doubt that, with suitable and probably minor alterations in working conditions, a material richer in germanium and gallium than the dust hitherto examined could be obtained. Tarry matter in a coke-oven gas main contained both metals.

The Hartley Yard coal seam in the Northumbrian area, the richest seam found, contains over 1 per cent of germanium. In attempting to inquire into the possibility of developing a germanium industry using flue dust, it was found that germanium is not uniformly distributed in the coal and that germanous oxide and sulphide being readily volatile, much of the germanium is lost when coal is reduced to ash. But these gases will sublime when the temperature is lowered; hence attention was drawn to flue-dust samples from the South Metropolitan Gas Co.'s monoxide main, which receives gas from a producer which has been filtered so as to free it of the larger coke particles. It was expected that the filter, by extending the distance traveled by the carbon monoxide, would allow it to cool enough and pass slowly enough to permit the germanous oxide to deposit.

Disquieting it is to realize, say the authors, that perhaps 2,000 tons of germanium and 1,000 tons of gallium are being dissipated into the British atmosphere or discarded as useless dust. Dusts from boiler flues had from a trace to 0.12 per cent of germanium and from nil to 0.17 per cent of gallium. In this instance, conditions for sublimation appear unfavorable. In comment, it might be said that if we have in the United States as much gallium in our coal as is in British coals and if it sold at present prices, which it certainly would not, and if it could find a market, extraction of gallium for a single year would pay off the national debt. A large market for the mineral could be obtained probably at a low price. Many metals when first produced had no more commercial value than gallium. Selenium and beryllium among others might be mentioned.

It may be added that according to F. L. Hesse, U. S. Bureau of Mines, 50 kg. of gallium is recovered yearly from refinery wastes and the value is only a twentieth of that stated, as set forth by Morgan and Davies. P. M. Taylor, also of the Bureau, prices it at $1.50 a gram, about a fifth as much as the latter authorities, and in small quantities at twice that price. Germanium is quoted by the same authority at $5.50 a gram and he says it may be employed for coating mirrors and for combating anemia. It also is a byproduct of zinc. If a real use for the metals could be found, they probably would sell at quite low prices.

Maximum Quantities of Germanium and Gallium in Gas-Plant Flue Dust Using Specified Coals

Source of Coal Used in Gas Plant	Maximum Percentage of Flue Dust as Germanium	Gallium	Source of Coal Used in Gas Plant	Maximum Percentage of Flue Dust as Germanium	Gallium
Durham	1.40	1.58	Scotland	0.29	0.13
Northumberland	0.94	0.44	Lancashire and Yorkshire (mixed)	0.33	0.41
Nottinghamshire	0.62	0.13	South Wales	0.06	0.32
South Yorkshire	0.40	0.55			

LUBRICATION of hoisting ropes is needed, not only to replenish the needed lubricant between strands and even between wires but to seal the surface and exclude moisture and dirt and to preserve the exterior of the rope, according to M. A. Hogan, Safety in Mines Research Board (British), addressing the Institution of Mechanical Engineers. The first of these functions generally is the most important, for internal deterioration, as a rule, is more dangerous and rapid than external. In some instances, lubricant on the rope's surface will reduce friction—on endless haulages, for example, causing slipping of clips or of the rope in the driving pulley—hence some other preservative dressing may have to be used.

Lubricant can be placed on ropes by a fine, high-speed spray which will penetrate any thin films of dirt or moisture on the surface of the wires. Experiments have been made on continuous lubrication of winding and haulage ropes at collieries. By use of a pump, a thin penetrative mineral oil has been applied to ropes passing over the top sheave of a headframe, keeping the rope clean and externally well lubricated.

Addition of wax to thicken an oil is undesirable, for waxes are inert bodies with little or no lubricating or protective value and must be regarded as adulterants from which the oil tends to separate. In ropes with fiber cores, the wax may be all that may be left in the core. Lubricants with soap as thickening have given good results in service.

On the whole, petroleum-base oils are insufficiently adhesive, and much study has been given to addition of materials to increase their adhesion. Wood tar may be used as a means of retention, but the organic acids in the tar introduce corrosion. Sticky distillation residues or asphaltic compounds may not retain their value in contact with the other oils in the rope. Natural graphite of low ash content may be incorporated with oil, but, as the graphite will not remain suspended, soap must be added for proper consistency.

Animal oils have been abandoned. Sperm oil, for instance, is somewhat readily hydrolyzed in the presence of water, and the products assist in rope corrosion. Seal oil, excellent as an exterior lubricant, leaches the mineral oil placed there during manufacture, leaving the wires unprotected. Metallic zinc as a galvanized coating lubricates wire contacts and protects the steel from corrosion.

HAND accidents are troubling British safety men. During the year 1935, says W. F. Richardson, Safety in Mines Research Board (Great Britain), in the 1937 *Sheffield University Mining Magazine*, 133,756 non-fatal disabling accidents, laying off men for more than three days, occurred in British mines, of which 9,376 involved the head 44,319 the hands, 15,030 the foot and 6,507 the eye. Note the number of hand injuries.

In his belief, a large number of the latter disablements doubtless could be eliminated, or their severity reduced, by wearing suitable gloves. Some workers claim that the heat and lack of flexibility of hand coverings interfere with their work, but these objections disappear surprisingly, when men become accustomed to wearing gloves. Some 35,000 pairs of gloves were supplied to Scottish mines in 1936, over 2,500 pairs are in use at a group of collieries in the English Midlands, and there is now a large demand for them in many parts of the coal fields.

Padded tongues are being provided in safety shoes to protect the instep. Shin guards are used to protect the legs of miners even when laboring at the face of the workings in seams of low inclination and thickness, but only where the men are driving rock headings or working at the loading ends of conveyors. The miners appreciate this protection. Shin guards

are perhaps the oldest type of protective equipment in Great Britain, having been used for many years by men working in thick, steeply inclined seams.

Knee pads and elbow pads are being used in thin seams, yet over 4,000 new cases of "beat knee" occurred during 1935. Knee pads are made of leather and felt, and newer forms are of rubberized materials. Special trousers incorporating rubber pads may be used or pads may be sewn inside the ordinary trouser knees. In comment, it may be said that, in Missouri, pieces of unshorn sheep hides for this purpose as well as rubber and leather have been in use many years.

R. Dawson Hall

On the ENGINEER'S BOOK SHELF

Requests for U. S. Bureau of Mines publications should be sent to Superintendent of Documents, Government Printing Office, Washington, D. C., accompanied by cash or money order; stamps and personal checks not accepted. Where no price is appended in the notice of a publication of the U. S. Bureau of Mines, application should be directed to that Bureau. Orders for other books and pamphlets reviewed in this department should be addressed to the individual publishers, as shown, whose name and address in each case is in the review notice.

Labor's Road to Plenty; The Return to the American Ssystem of Productivity, by Allen W. Rucker. L. C. Page & Co., Boston, Mass., 222 pp., 5¾x9 in.; cloth. Price, $2.50.

Defining the American system as "freedom of enterprise with rewards proportionate to productive effort," the author in what follows seems to qualify this to mean "productive result" rather than "productive effort." In his belief, the nation broke away from its time-honored moorings not with the advent of the New Deal but when the Federal Reserve Board, in 1921, undertook to stabilize the general price level and the Federal Government assumed responsibility for fixing hourly wage rates of railroad employees. Since that time, it has become a recognized "notion that the way to avoid the penalty of underproductivity is to regulate the activities of the productive—and compel them to share the rewards of their efforts with the comparatively non-productive." Already, in the boom year, 1929, official records show that 425 manufacturing corporations out of every 1,000 failed to make any net profit.

Average annual income per employee and average value of product per worker in any industry bear year by year almost a definite ratio to one another—so much so that, in the opinion of the author, the former could be based in all fairness on the latter. To reduce the ratio between annual value of product per employee and average annual wage would cripple the industry in which the ratio is diminished. Boldly and, the reviewer would add, questionably also, Mr. Rucker declares that the dollars' receipt for the worker's product is a measure of its value to the public, but, in so holding, he overlooks the fact that labor rates, which have been largely regulated by union, political and legislative pressure, quite measurably determine what the dollars' receipt for that product shall be.

The number of going factories decreased between the years 1929 and 1933 and rose between the years 1933 and 1935 almost in the same percentages as the number of men employed respectively declined or rose in the two periods, showing, declares Mr. Rucker, that employment opportunity is dependent on the number of factories in operation. Employees think that they are merely drawing on company profits when, by union action or by legislation they compel wages to be raised and hours to be reduced, but though in 1923, only 62.1 per cent of active manufacturers showed a net income, in 1929 that meager figure had dropped to 57.5 per cent, showing how deadly was the effect of labor agitation and legislative enactments. Only 48.9 per cent as many manufacturing corporations were earning a profit in 1933 as in 1923, and, what is more, total payrolls dropped to 47.8 per cent of their 1923 proportions in that same ten-year period. Labor therefore suffers as grievously as capital from labor's insatiable effort for aggrandizement.

Much stress is laid by Mr. Rucker on the failure of the anthracite, bituminous and railroad employees—despite shortened working days and higher wage rates—to obtain their real objectives, which are stability or increase of annual wage rates and work for all men belonging to the industry. However, these are industries with new forms of competition and therefore perhaps not truly illustrative of more normal employments.

The author is unusually clear and competent and believes he has the key of the situation. If there is a key to unlock the present-day labor perplexities other than an old one of the ultimate battering down of the door by the bitter disillusionment of labor in its present leadership and aims, this one which Mr. Rucker presents looks more promising than any other.—R. DAWSON HALL.

Mineral Resources of Kansas Counties; Mineral Resources Circ. 6, by K. K. Landes, University of Kansas, Lansing, Kan. 110 pp., 5½x8⅜ in.; mimeograph.

Coal is reported in Bourbon, Cloud, Coffey, Crawford, Douglas, Franklin, Jefferson, Labette, Leavenworth, Linn, Neosho, Osage and Wilson counties, all in the southeast, except Cloud County, where the coal is a black lignite of the Dakota formation, Cretaceous Age, in which are two small mines. At one plant the pyrite from the coal beds is concentrated, to be roasted in St. Louis for the manufacture of sulphuric acid; iron oxide thus obtained is used as paint pigment, blast-furnace charge or to make high-density solutions. The bulletin lists counties alphabetically and describes briefly in each case the resources therein found.

Geology of the Muskogee-Porum District, Muskogee and McIntosh Counties, Oklahoma, by C. W. Wilson, Jr., and N. D. Newell. Oklahoma Geological Survey, Norman, Okla. Bulletin 57, 184 pp.

This bulletin covers paleontology, structure, economic geology, coal, oil and gas and other resources of the region, the coal in which runs from 5 to 20 in. in thickness and is recovered by scrapers and a steam shovel.

Recommendations of the United States Bureau of Mines on Certain Questions of Safety as of Oct. 1, 1936. I. C. 6946; 45 pp.; mimeograph.

This circular gives the 27 decisions made by the Mine Safety Board of the U. S. Bureau of Mines regarding certain safety questions about which the greatest differences of opinion have arisen, beginning with the first on miners' lamps, May 8, 1926, and ending with the decision of July 13, 1935, on construction of shaft linings. Though they may not register universal approval, they represent excellent practice and should be studied for greater safety in mining.

Some Physical Characteristics of West Virginia Coals, by C. E. Lawall and C. T. Holland. Research Bulletin No. 17. Engineering Experiment Station, West Virginia University. 50 pp., 6x9 in.; paper.

The first nineteen pages of this publication cover the same ground as the article delivered by the same authors before the American Institute of Mining and Metallurgical Engineers at the meeting of that institute in February, 1932 (*Coal Age*, March, 1932, p. 97). To this are added chapters on compression and weathering characteristics, with some sampling theories by M. C. Holmes.

Fuel Briquettes from Alabama Lignite by Destructive Distillation at Low Temperatures and Briquetting the Residue Without a Binder, by C. A. Basore. Alabama Polytechnic Institute, Auburn, Ala. Bulletin 8, 23 pp.

Raw Alabama lignite is air dried, then preheated or subjected to low-temperature distillation at a temperature sufficient to remove practically all the water and much of the volatile matter. The preheated lignite residue is then ground, moistened with 8 per cent of water and briquetted without binder at 212 deg. F. under a pressure of 13,500 lb. per square inch. Briquets that withstand handling and weathering, if protected from direct rainfall, are thus produced. This method, says the author, may not be applicable to all Alabama lignites.

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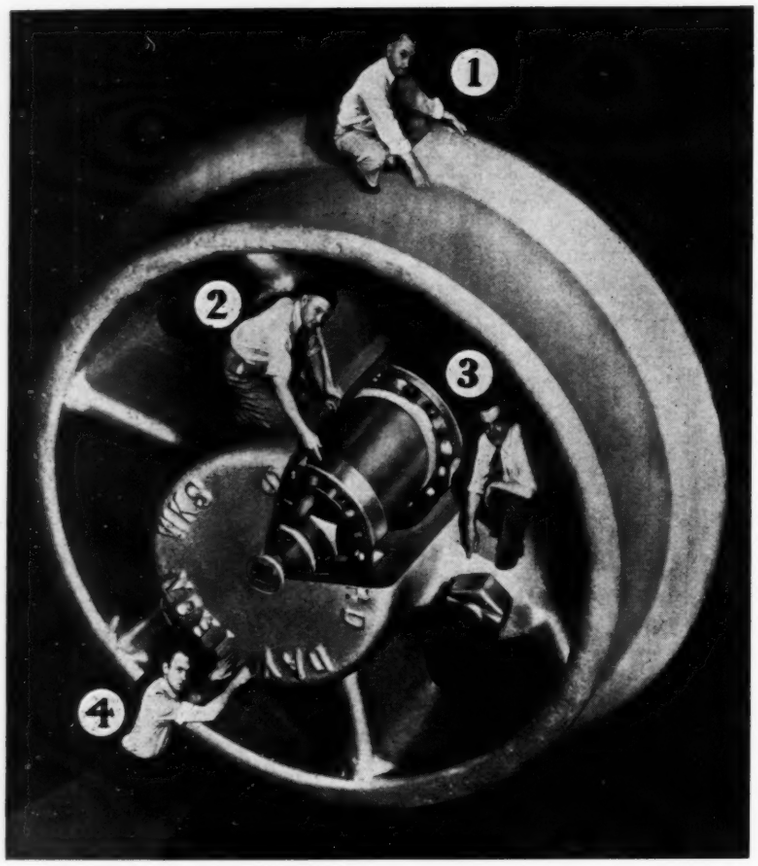

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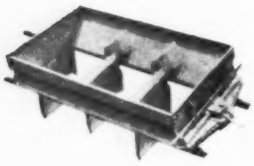

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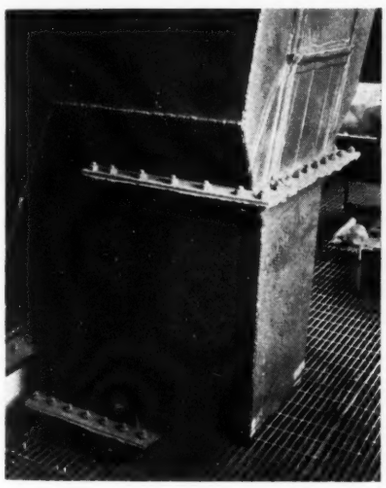
Material-Filled Elbows Cut Chute Wear

Where it is necessary to change the direction of drop chutes in the Isabella (Pa.) preparation plant of the Weirton Coal Co., elbows are used instead of slanting chute sections. Such an elbow is



Showing use of elbow to prevent chute wear.

shown in the accompanying illustration of a refuse chute on one of the two washing units. This elbow fills with refuse material, which forms a cushion against other falling material, and also permits the remainder of the chute to be installed so that a straight fall is possible.

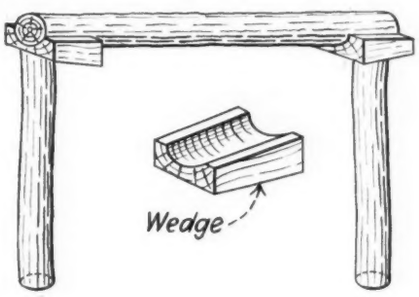
Setting Round Crossbars With Preformed Wedges

In timbering, particularly in airways where cost and minimum resistance to air flow are of more than usual importance, Anthony Shacikoski, mine foreman, Cochrane Coal Co., Salina, Pa., has used and recommends round, or unsawed, crossbars. Locust preferably is used, because of its longer life, while unsawed timbers were selected because they are less subject to fungous attack.

The wedges, or caps, used on the tops of the legs were hewed out of locust logs to the shape of the round crossbars. In addition to shaping them to fit the bar, the wedges also were tapered from one end to the other so that when they were driven up solid they would tend to tighten the bar up against the roof or lagging. Where lagging was employed, it was cut out to fit over the bar.

In addition to reduced interference with air flow, round crossbars, Mr. Shacikoski contends, are stronger than the usual type of bar in that no cutting is done to permit the bar to rest on the tops of the legs and thus there is no disturbance of the natural structure of the beam to offer a weak point at which splitting can start due to exposure of the grain of the wood. This exposure of the grain also is a factor in the increased splitting frequently observed in the case of sawed timbers as compared with the unsawed type.

Commenting in general on sawed vs. unsawed timbers, Mr. Shacikoski expresses the opinion that round, unsawed members are safest in drifts subject to the full effect of winter temperature changes. In the case of sawed timber, the grain of the wood is exposed to and absorbs moisture, which freezes and swells when the temperature drops, thus opening up the cracks and exposing more of the wood to attack by fungus, with attendant rot. Also, if the grain of the piece runs



Showing how preformed wedges are used in setting round crossbars

across it at an angle, the formation of a crack may render the bar useless. Unsawed timber, on the other hand, is in its natural state and consequently is less subject to the agents of deterioration noted above.

As a sidelight on the use of the wedges or caps described above, Mr. Shacikoski points out that in case installation of timber sets is attempted without the use of tapered wedges, the bar first is forced up as the leg is driven back into position, because until the leg is in position the back edge naturally is higher than the front. Consequently, after the leg is in place, the bar settles down slightly to its final resting place, resulting in a loss of height.

Unbroken Panel Pillars Save Money in Mines

"The penetration of panel pillars with entries or rooms for no worthy cause can result in much harm," declares E. A. Smith, chief engineer, Central Elkhorn Coal Co., Estill, Ky. "Such a practice can be a direct cause of menace to the new workings from water, gas and 'bad' air. It is only too easy to sever panel barriers at points too low in elevation to safeguard future works against water.

"So many times the water within an old panel can be drained to lower levels within another old panel or to an outcrop opening in the interest of efficiency. Not infrequently the return air current can be passed through the old panel to advantage, as the additional room results in a lower resistance. It is conducive to economy to keep the panel barrier unbroken until a well-checked series of elevations has been established on all sides of the panel. Proper projections from such information can be made for crosscuts at points on high ground for drainageways, airways, openings for water-discharge lines from pumps, etc.

"In one mine in the Elkhorn coal field of northeastern Kentucky some 100,000 tons of water had accumulated in an old panel of some 200 acres in area. However, the same water would have been going into the workings, only to be pumped out at extra expense. It was the good fortune of the operator to be able to remove this water at a nominal cost by means of a ditch at the outcrop at the rate of 6 300 tons, or 56 in.-acres, of water every 24 hours.

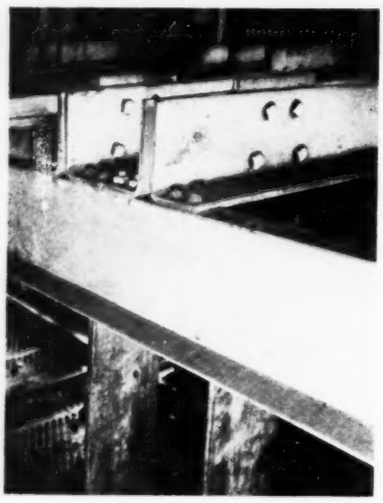
"Hereafter, all water about the work-

ings can be pumped into the old panel with little friction head and against practically no actual head, and from there will pass out of the mine at the outcrop opening. Air can pass through the panel with a direct saving in power proportionate to the reduction in resistance.

"Recent pumping of water was against a pressure of 176 lb. per square inch at an extra cost of $25 per 24 hours. This cost now is eliminated by the well-planned and protected barrier pillar. Including neither the estimated saving in ventilation nor in drainage in the future, this direct saving of $25 per day, or $9,125 per year, seems ample justification for the preservation of panel pillars."

Shaker-Arm Supports Reduce Breakage

Flexible shaker hangers in the Isabella (Pa.) preparation plant of the Weirton Coal Co. and clamped-in supports are designed both to reduce breakage and facilitate adjustment in installation. The supports, as shown in the accompanying illustration, are made of bent plate instead of angles. Bending results in a rounded corner and consequently there is no sharp edge for the arms to work against. Consequently the radius of the bend is greater and there is less likelihood of breakage.



Rounded corners on these hanger supports reduce likelihood of breaking the arms.

Supports are bolted to the tipple members through holes. On one side, these holes are elongated into ovals so that one support may be moved as necessary in installing new hangers to compensate for any variation in thickness.

Machine Noises Eliminated In Several Ways

One of the biggest forward steps in late years in the matter of cutting down machine noises is the isolation of the machines from their surroundings to check transmission of vibration, writes John E. Hyler, Peoria, Ill. "Those who have had experience with vibrating machinery know that it is very noisy, many times resulting in vibration of the entire building in which it is operated. By interposing a layer of vibration-deadening material, such as prepared cork, between the machine and the floor, the vibration is done away with.

"A nerve-wracking thing for the man who is more or less continuously subjected to it is a knocking bearing. Where there are several bearings it is hard to tell where the trouble is unless one has had experience in detecting slightly loose bearings. One very good method is to take an oil can from which the oil flows freely and, filling it with oil, go over the bearings one by one, with an interval of time between the various applications. Apply a generous quantity of oil to a bearing as suddenly as possible and then take particular note of the sound effect. If the knock you have been hearing is reduced suddenly, you have found the trouble maker. There are other methods that can be used, but the one cited is as good as any.

"A periodic squeak in a machine is about as bad as a knocking bearing—worse for some people. It is possible for a squeak to be in a bearing, but in most cases it will be found elsewhere. Some slight interference with mechanical motion usually is the root of a machine squeak and sometimes it is very hard to find. In one case that came to our attention lately, the squeak finally was traced to a very small imperfection in the cutting of a gear so that it squeaked once each revolution.

"A squeak often occurs in a revolving part, and by using the time principle of checking it often can be traced more easily to its source. For example, take a machine with a number of rollers revolving at one speed and with other elements revolving at other speeds. We are going to find out, let us say, whether the squeak is in the rolls or in the gears that drive them. Taking a position adjacent to the revolving rolls, we hold a piece of chalk above one of them. The instant the squeak is heard, we make a mark on the top of the roll. Then we wait until the roll makes another revolution, and if the squeak is repeated just as the chalk mark returns to the upper position, the squeak is proved to be in the rolls, the gears that drive them or in some connected member having the same revolution timing. If the squeak does not repeat in the manner described above, it is just as conclusively proved that the trouble is not in that part of the machine.

"Where either a squeak or a knock is heard there is vibration present which sometimes can be detected by feel if one has his sense of touch carefully developed. If your fingers are not sufficiently sensitive for tracing by this method, try holding a lead pencil in your teeth and pressing it against stationary parts adjacent to the suspected moving parts. This will be found helpful in many cases where the trouble cannot be detected otherwise."

Lively, Please!

With the increased use of machinery, particularly of the high-tonnage type, trouble means fast action on the part of the men at the mine if output is not to suffer severely for the day. So the prudent mining man tries to forestall trouble by removing all possible causes in advance, at the same time keeping in reserve a number of remedies which can be applied immediately in case any difficulty does arise. Such remedies may come out of his own head or may be based on the experience of others. These pages are designed to present what the other operating, mechanical, electrical or safety man has done. So if you have an idea that will cut cost, increase production or promote safety, here is the place for it. And, to make it worth your while, Coal Age will pay $5 or more for each acceptable idea. A sketch or photo should be included in case it will assist in making the idea clearer.

Micarta Pump Rings Reduce Maintenance At Three Anthracite Collieries

THE acid condition of mine water plus an ever present percentage of silt is the main cause for the unusual wear on centrifugal-pump parts around the mines. Coal-company engineers are continually experimenting with new materials for impellers, casings and wearing rings in an effort to obtain some material that can withstand these agents of deterioration and thus reduce maintenance to a minimum. It is in the application of pump wearing rings that micarta has come to the fore as the material to meet this need, states William E. Connor, industrial division, Westinghouse Electric & Mfg. Co., Wilkes-Barre, Pa.

"To get a fair picture of the vastness of the pumping problems," says Mr. Connor, "we should first consider the fact that at an average working colliery approximately 12 tons of water must be pumped for every ton of coal mined. This figure, of course, will vary, depending on the location of the colliery as well as the time worked. Also, when we consider that pumping must be done in idle or abandoned mines to keep that water from flowing into a working mine,

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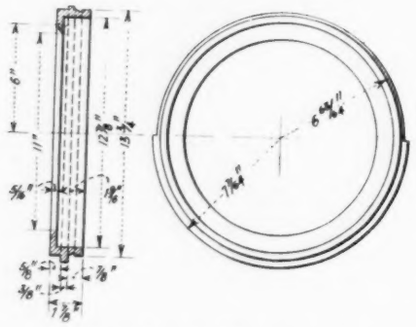


Working drawing of micarta ring

it is easy to conceive that over a year the ratio of total water pumped by a company would more likely be in the neighborhood of 25 to 30 tons per ton of coal mined. Hence, we see that a considerable number of pumps are required, in turn introducing a major maintenance problem.

"Starting with the pump casing, these can be obtained in bronze or chrome iron, depending on the condition of the water where they are to be used. Where a prior analysis shows a solution of, let us say, twenty grains of free sulphuric acid and acid salts of aluminum and iron, which combined might make a total active acid content running as high as fifty grains to the gallon, it is often found to be more economical to overlook initial cost and use chrome iron instead of bronze. The same is true of the impellers. Here we find bronze or chrome iron the most common practice.

"As for the wearing rings, which act as a seal between the moving and stationary parts of the pump, bronze, chrome iron, stainless steel and hard rubber have been tried, but each of these had an inherent disadvantage. The bronze was effective for a time but the rapid rate of wear, with consequent increase of clearance, resulted in short life. Chrome iron as a wearing ring, while it resists wear quite well, requires a rather liberal initial clearance if used in conjunction with a chrome-iron impeller, due to the readiness with which it seizes. This would, in turn, eventually stall the pump and possibly cause serious damage, while the extra clearance at the outset would mean a lower operating efficiency to start with. The cost of stainless steel proved prohibitive for the short increase in life accomplished. Hard rubber worked exceptionally well from the standpoint of imperviousness to acid and abrasives, but its main drawback was its mechanical weakness.

"The foregoing experiments showed that a non-metallic ring with sufficient mechanical strength and a resistance to acid and silt would solve the problem. One of the larger anthracite producers, as well as a smaller independent, installed a set of micarta rings, which, from all reports, have far exceeded anything heretofore used. On one installation, a pump was in service thirteen months before repairs became necessary. The normal severe wear on the impeller required its renewal, whereas the stationary rings of micarta showed little, if any, wear and were put back into the pump again with the new impeller. Thus about twice the length of service was obtained on this pump between changes of impeller.

"In the case of the larger company, the rings were installed on a pump in one of the most severe locations from the standpoint of acid and silt possible at any of its operations. Previous records had shown that the pump had to be taken out of service every six or seven weeks because of ring wear. After the installation of the micarta rings the pump operated thirteen weeks before it had to be torn down, and this time it was found that the impeller had been worn so badly that it could not be used again, whereas the rings still were in good condition. In fact, they required only a little truing-up and were again installed in the pump with the new impeller. The wearing rings are solid, as shown in the section of working drawing reproduced in the accompanying figure.

"Micarta, by permitting close clearance, reduced vibration instead of increasing it as would be the case if two identical metals were used. This close clearance, in turn, gives better efficiency and smoother performance of the pumps in general.

"Experience has shown that it is highly desirable in the case of micarta rings to have them held in the casing by a tongue extending entirely around the ring rather than in the lower half of the casing only. Without the benefit of this tongue, the water pressure may force the ring out of place and even break it. Rotation of the ring in the casing is prevented by making the radius of the tongue in the upper half about ¼ in. less than in the lower half.

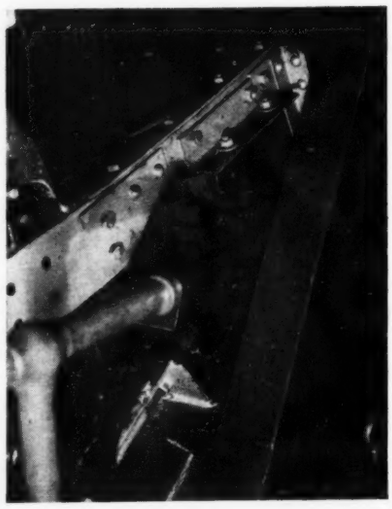
"While the initial cost of bronze rings might not exceed half the cost of micarta, this difference would be offset by the double service life from micarta rings, not to mention the additional savings resulting from less labor required for the more frequent changes of bronze. In a comparison of cost of micarta with chrome iron, stainless steel or hard rubber, it probably would be found in most cases that the micarta would be cheaper in first cost with a service life as great as, or greater than, any of these.

"At the present time there are three sets of micarta rings operating in pumps of three different coal companies in Pennsylvania. If performance for the past eighteen months can be taken as any criterion, it is a certainty that these will prove as satisfactory as the first two sets tested."

—◈—

Rubber-Flight Conveyor Cleans Belt

A short flight conveyor with rubber instead of steel flights is doing a fairly successful job of cleaning a conveyor belt in the Isabella (Pa.) preparation plant of the Weirton Coal Co. As shown in the accompanying illustration, this auxiliary conveyor is mounted under the end of the conveyor and the flights work in the opposite direction to the belt travel. Speed of the main belt is 306 f.p.m., while the



The auxiliary rubber-flight conveyor appears just beneath the return idler and main belt in this view of the installation.

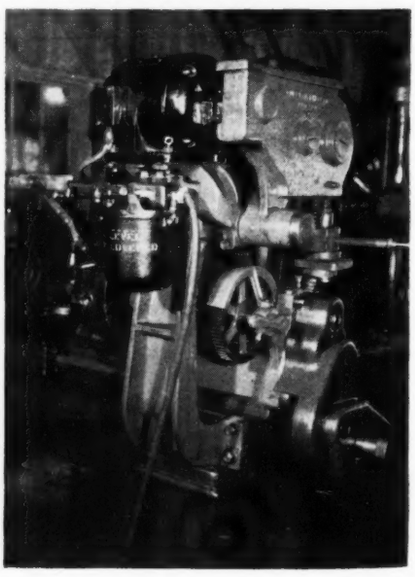
speed of the auxiliary conveyor is 40 f.p.m. In addition to the main rubber flights, the auxiliary conveyor also is fitted with a few steel flights. The latter are thrown down by a cam as they come up to where they would strike the belt, and are raised back up to position when on the bottom to scrape the fines out of the collecting pan beneath the conveyor.

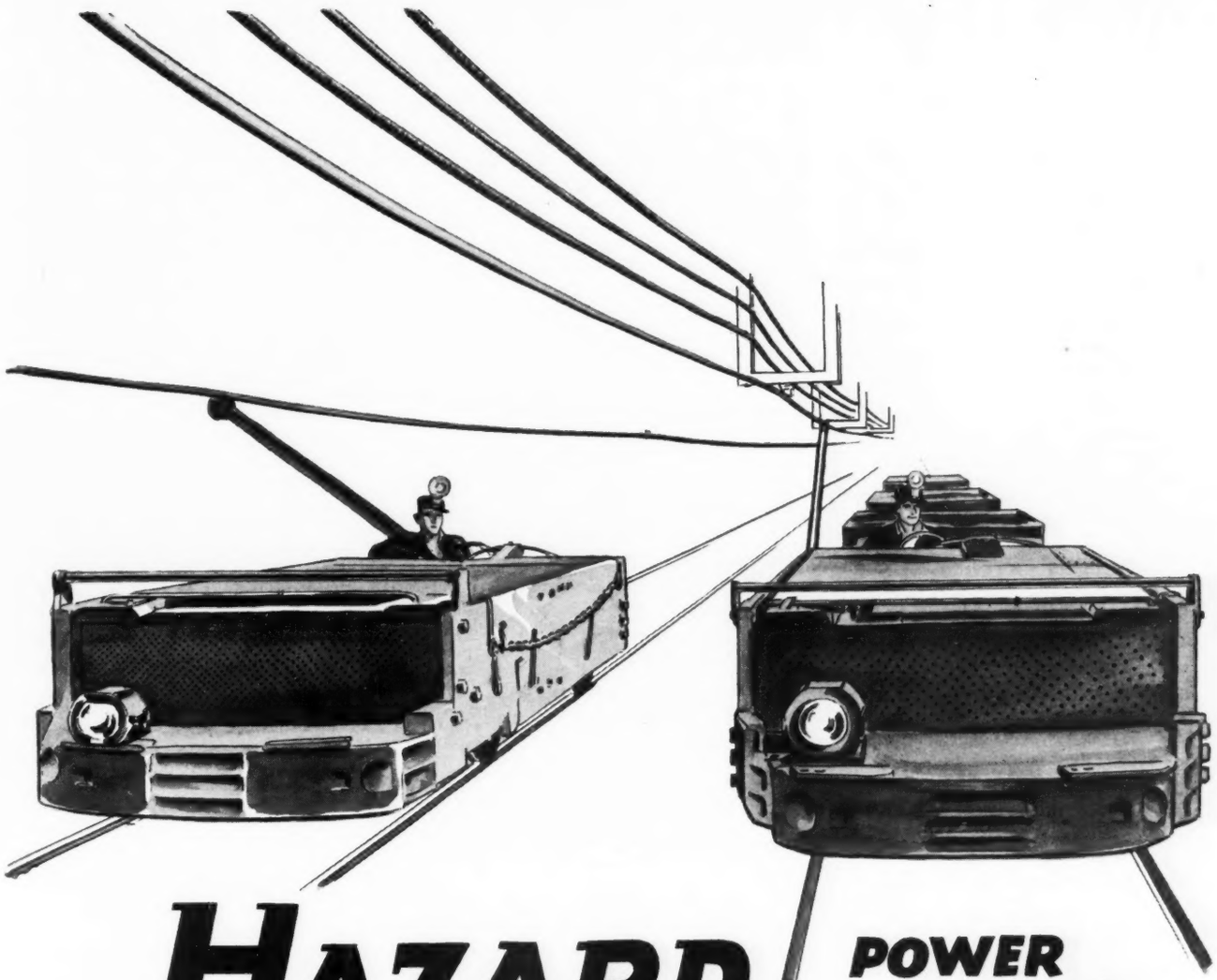
—◈—

Changes to Individual Drives Use Factory Mountings

Modernization of shop equipment at the Prenter (W. Va.) operation of the Red Parrot Coal Co. included a change from lineshaft to individual motor drives. To facilitate making the change, special brackets complete with auxiliary fittings

Four bolts or capscrews fasten the special bracket to the lathe bed





HAZARD POWER CABLES

Hazard Armortite non-metallic armored cable is widely used for power transmission in mines. It does away with all the objections to metallic armored cables, but sacrifices none of the advantages. Individual conductors are insulated with Hazard Submarine rubber, which is particularly resistant to moisture, and other destructive agents present in many mines. The non-metallic armor tape resists mechanical injury, yet Armortite cable is light in weight, and easy to handle.

HAZARD INSULATED WIRE WORKS

DIVISION OF THE OKONITE CO.
WORKS: WILKES-BARRE, PENNSYLVANIA

New York Chicago Philadelphia Atlanta Pittsburgh Buffalo Boston Detroit
Seattle Dallas Washington San Francisco St. Louis Los Angeles

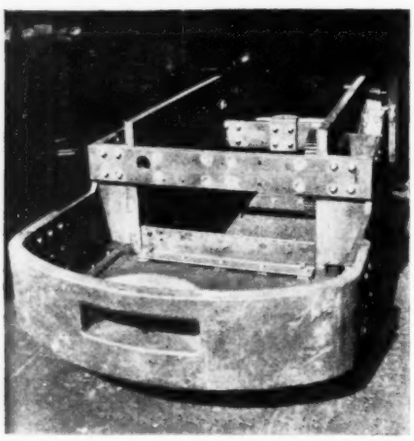
were purchased from the Cullman Wheel Co., Chicago.

The illustration shows a 16-in. South Bend lathe with the motor mounted on a special bracket. The old cone pulley from the lineshaft is utilized on the new drive and the tension adjustment for belt shifting and tightening is conveniently provided for by a toggle and lever. In the foreground and just below the motor may be seen a General Electric oil-immersed reversing controller which is operated from a sliding bar positioned conveniently above the lathe bed.

Four of these factory-made bracket-type individual drives have been applied thus far to machine tools in the Prenter shop. In addition to the one pictured, these applications include a 24-in. South Bend lathe, a 46-in. wheel lathe of the same make, and a Norton shaper.

Cast-Steel Bumper Provides More Space for Motorman

Low coal, averaging 3 ft. 6 in. at the ten mines of the New River Co., calls for low equipment and in the case of locomotives operating under these conditions safety requires proper deck room for the motorman. Recent adoption of a combination cast-steel bumper and deck-plate extension for the control end of the gathering locomotives has provided 8 in. more deck length for the motorman without increasing the over-all length of the locomotive.



This cast-steel front-end bumper provides additional deck room for the motorman.

The illustration, from a photograph made in the central shop at Mount Hope, W. Va., shows a 6-ton locomotive to which a cast-steel bumper has been applied during the rebuilding and remodeling process which has been in progress for several years with the locomotives operated by the company.

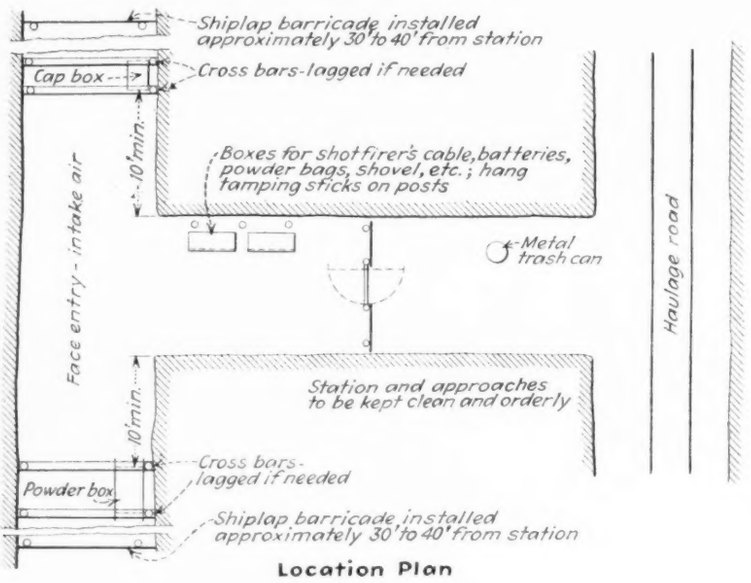
This bumper, which was designed by the coal company and weighs 712 lb., was cast at Parkersburg, W. Va. The bottom edge extends back to meet the old deck plate and thus forms a part of the deck bottom. The recessed sides have a shoulder against which the locomotive frame plates butt. Thirty 6-ton gathering locomotives of the 803 and MH-88 types have thus far been equipped with this cast-steel front bumper.

Use of the standard bumper patented by A. R. Long, formerly a mine superintendent for the New River Co. and now proprietor of the Long Super Mine Car Co., Inc., is being continued on the opposite end of the locomotives. Operatives prefer the Long-type bumper because of the top clearance provided for coupling the cars.

Weirton Inside Magazines Built for Safety

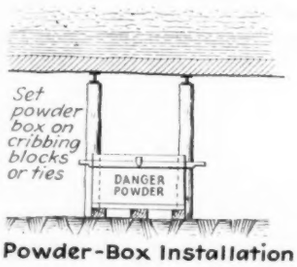
As in other operations at the Isabella (Pa.) mine of the Weirton Coal Co., safety is the first consideration in the construction of inside magazines for permissible explosives and caps. Such magazines, as indicated in the accompanying standard plan of installation, are located in back headings on fresh intake air. Entrance to the magazine is through a gate in a fence erected in a crosscut. The powder box is located at least 10 ft. from one rib of the crosscut, with the cap box, also at least 10 ft. from the crosscut rib, on the opposite side. Crossbars, lagged if necessary, are placed above both the powder box and the cap box. The latter is hung by hooks on two posts, while the powder box is set on cribbing blocks or ties.

Both the powder box and cap box, as well as the shotfirer's tool boxes, are equipped with locks. The powder box is lined with asbestos-compound sheeting for protection against moisture. Holes in the bottom permit the sawdust in which the explosive sticks are packed to run out of the box, and a tray is placed beneath the box to catch the sawdust and prevent it from being scattered about on the floor. The tray also facilitates disposal of sawdust accumulations in a safe manner.

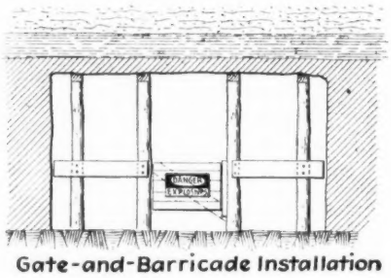


Location Plan

Cap-Box Installation



Powder-Box Installation



Gate-and-Barricade Installation

Details of inside magazine installation at Isabella mine.

WORD FROM THE FIELD

Stream-Pollution Control Shorn of Teeth

Final approval by the House of Representatives on June 13 of the conference report on the stream-pollution bill sent to the White House for approval a measure that has been in bitter disagreement for a year. As finally approved, the bill is shorn of the "teeth" that aroused so much opposition, but its proponents promise to return to the attack in force unless substantial progress is made in cleaning up objectionable stream conditions within the next few years.

As first approved by the House on April 21, 1937, the bill sets up in the Public Health Service a new Division of Water Pollution control headed by a commissioned engineer officer with the rank of Assistant Surgeon General. The work of this division will include study of pollution problems and preparation of plans for their amelioration, as well as administration of grants-in-aid by which the Federal Government will participate in the cost of remedial works. Provision is made for a five-man board of review that will function similarly to the Board of Engineers for Rivers and Harbors in the field of navigation and flood-control works. Annual expenditures of $300,000 for administration and $700,000 grants to the States are authorized. Construction grants will be authorized and appropriated individually, following the procedure in other stream-improvement measures. In all its work the division is directed to cooperate closely with State agencies operating in the same field.

The Senate, before passing the bill on Aug. 14, 1937, added amendments authorizing the division, after three years, to set up pollution standards which, if exceeded, would give ground for legal action by the Federal Government to force remedial measures. House conferees resolutely refused to accept these amendments and the result was the long deadlock just ended by scrapping of the Senate amendments.

Borderland Control Passes

J. T. Morris, president of the Borderland Collieries Co., Borderland, W. Va., has sold his interest in that company to Andrew F. and W. S. Leckie, Columbus, Ohio. He also has disposed of his holdings in the Leckmor Realty Co. to the same buyers. Mr. Morris has been interested in the Borderland company for the last eleven years. Previous to that he had organized the Morris Smokeless Coal Co., Morco, W. Va., subsequently becoming vice-president and general manager of the MacBeth Coal Co., in Logan County, and the Morrison Coal Co., Glen Morrison, W. Va.

Virginian to Build Coal Line

Authority has been granted to the Virginian Ry. to construct an eight-mile extension in Wyoming County, West Virginia. Construction, which will provide railroad service to coal land tributary to the Guyandot River line, will begin about Aug. 1 and be completed in about a year.

Keeping Step With Coal Demand

Bituminous Production

Week Ended	1938 (1,000 Tons)	1937* (1,000 Tons)
May 7	4,864	6,984
May 14	5,170	7,226
May 21	5,127	7,397
May 28	5,500	7,576
June 4	4,853	6,596
June 11	5,170	7,058
Total to June 11	138,054	202,936
Month of May	**21,995**	**30,077**

Anthracite Production

May 7	823	931
May 14	820	1,035
May 21	1,089	1,068
May 28	1,288	1,165
June 4	1,128	976
June 11	870	1,086
Total to June 11	21,525	25,375
Month of May	**4,270**	**4,281**

* Outputs of these two columns are for the weeks corresponding to those in 1938, although these weeks do not necessarily end on the same dates.

Bituminous Coal Stocks

	(Thousands of Net Tons) May 1 1938	April 1 1938*	May 1 1937
Electric power utilities	8,395	8,479	8,504
Byproduct coke ovens	4,935	5,231	8,544
Steel and rolling mills	779	837	1,748
Railroads (Class 1)	5,548	5,860	8,206
Other industrials†	9,286	9,852	12,719
Total	28,943	30,259	39,721

Bituminous Coal Consumption

	(Thousands of Net Tons) April 1938	March 1938*	April 1937
Electric power utilities	2,670	3,015	3,294
Byproduct coke ovens	3,457	3,795	6,247
Steel and rolling mills	649	787	1,226
Railroads (Class 1)	5,801	6,427	7,472
Other industrials†	8,271	9,236	12,213
Total	20,848	23,260	30,342

* Revised. † Includes beehive ovens, coal-gas retorts and cement mills.

Second Coal-Cost Hearing Set As Denver Sessions End

WASHINGTON, D. C., June 20.—Continuing its efforts toward the reestablishment of minimum prices under the Guffey-Vinson coal control act, the National Bituminous Coal Commission announced last Thursday that it would begin its second big hearing here on July 6 to determine the cost of producing coal in Minimum Price Area I, comprising Districts 1 to 8 and part of District 13. The producers' boards of these districts were notified to submit the necessary data for determination of the weighted average cost for the price area.

The Commission announced the costs per net ton for Districts 1 to 8 as determined by the respective district boards as follows, from figures compiled by Commission statistical bureaus: District 1 (eastern Pennsylvania), $2.3940; District 2 (western Pennsylvania), $2.2948; District 3 (northern West Virginia), $1.8745; District 4 (Ohio), $1.9755; District 5 (Michigan), $3.5679; District 6 (West Virginia Panhandle), $2.0167; District 7 (southeastern West Virginia and part of Virginia), $2.2087; District 8 (southwestern West Virginia, eastern Kentucky, northeastern Tennessee and part of western Virginia), $2.0535. The figures were based on 1936 costs, adjusted so as to reflect changes in conditions since then.

The Commission stated that the hearing will be informative in type and consumers may participate by themselves or through the Consumers' Counsel. Persons wishing to participate are required to file written notice at Washington not later than the day before the hearing, stating the nature of their interest and giving a concise written statement of the facts it is desired to protect.

Proposed Cost Figures Indorsed

The first hearing to determine costs in Minimum Price Areas 6, 7, 9 and 10, consisting of the Rocky Mountain and Pacific Coast sections, was concluded at Denver, Colo., last Thursday, after sessions lasting four days. Most of the witnesses questioned on costs agreed that the figures proposed by the boards were reasonable. The boards' figures were: District 16 (northern Colorado), $2.5651 per ton; District 17 (southern Colorado), $2.7989; District 18 (New Mexico), $3.1603; District 19 (Wyoming), $2.1146; District 20 (Utah), $2.5064; District 22 (Montana), $1.5723; District 23 (Washington, Oregon and Alaska), $3.2786. Chairman Tetlow presided at the Denver sessions, with these Commissioners also sitting: John C. Lewis, Pleas E. Greenlee, Walter H. Maloney and C. E. Smith.

A witness from Montana, however, stated that the inclusion of captive tonnage in the tabulations for District 22 would

certainly result in commercial mines being forced to sell their coal at less than production cost—perhaps as much as 68c. per ton below. Preceding the hearing, District 20 (Utah) board addressed a resolution to the Commission protesting against including captive production, contending that it would be "bound to result in inequity to commercial producers."

The Commission, in an order issued on June 1, denied and dismissed petitions by the Mallory Coal Co. and others, as well as the Rochester & Pittsburgh Coal Co., which requested that the ruling of March 30 construing the coal act to permit the introduction in evidence at a hearing before the Commission of individual cost data of producers be vacated. The Mallory company and co-plaintiffs, however, asked the U. S. Circuit Court of Appeals on June 7 to enjoin the Commission from making such data public.

The Sunshine Anthracite Coal Co., Johnson County, Arkansas, which filed suit to restrain an internal revenue collector from attempting to collect a 19½ per cent excise tax levied by the act against producers who are not members of the code set up by the measure (*Coal Age*, June, p. 86), obtained a temporary injunction in a unanimous opinion by a three-judge court on June 4. The Commission has scheduled a hearing for Friday in regard to exemption of the company from compliance with the act.

Just before Congress adjourned it halved the appropriation of $500,000 recommended by President Roosevelt to be granted to the Commission to investigate arrearage in penalty taxes under the coal act. The House included the original sum in the final deficiency bill; the Senate trimmed it somewhat, however, and then conferees of the two houses cut it to $250,000, which was approved by both chambers.

Rehabilitating Alabama Mine

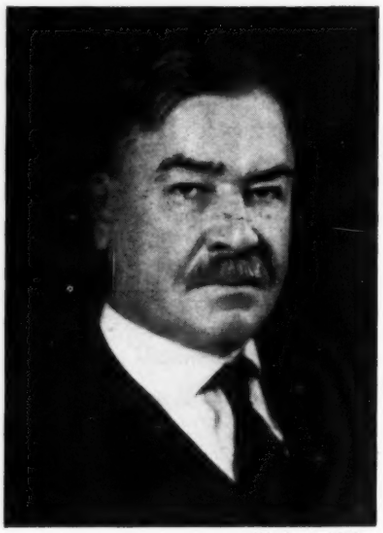
The Black Diamond Coal Mining Co., Birmingham, Ala., has started rehabilitation of No. 9 mine, at Blocton, which it has leased from the Tennessee Coal, Iron & Railroad Co., after being idle for about fifteen years. The operation is being dewatered preparatory to the work of cleaning up, timbering, laying tracks, and installation of mining, loading and haulage equipment and facilities. A tipple and washery are being constructed.

P. & R. Would Close 5 Mines

Permission to close five unprofitable mines and dispose of undeveloped lands on which there is an annual tax of $1,000,000 was sought from Federal Judge Oliver B. Dickinson in Philadelphia, Pa., on June 16 by the Philadelphia & Reading Coal & Iron Co. Authorization to borrow $2,500,000 for working capital also was requested. Seeking reorganization under the bankruptcy act, the company asserted that if it could discontinue the unprofitable mines and dispose of 123,000 acres, of which 72,000 are barren and 51,000 undeveloped, by the end of 1942, it would be a "going concern." The company owns 154,000 acres. The court referred the petition to a special master who has been hearing proceedings for reorganization.

Inspectors Chart Mining Safety Progress At 29th Meeting in Springfield

AGAIN bringing forth the latest thought on safety, the Mine Inspectors' Institute of America convened for its 29th annual convention at the St. Nicholas Hotel, Springfield, Ill., last month. With James McSherry, director, Illinois Department of Mines and Minerals, and chairman of the local committee on arrangements, as temporary chairman, the three-day meeting got under way on June 6. Richard Maize, Pennsylvania State mine inspector and retiring institute head, presided over the technical sessions on June 6 and 8. Delegates and guests visited the new Buckheart strip mine of the United Electric Coal Cos. (*Coal Age*, March, 1938, pp. 49-57) on June 7. Proceedings at the annual banquet were under the direction of J. T. Ryan, president, Mine Safety Appliances Co., who supplemented his labors as chairman of the program committee by acting as toastmaster.



Blank & Stoller

Dr. J. J. Rutledge
New Institute President

Topics at the technical sessions included: electricity underground, the prevention of electrical explosions, means of keeping supervisors up to date on safety procedure, water in abandoned mines, sudden outbursts of gas, and safety at the mines of the Union Pacific Coal Co. and in Illinois. In the business sessions, members of the institute, in addition to electing new officers, referred a proposed anthracite explosives code to a committee composed of P. J. Friel, S. J. Phillips and William Clements, anthracite mine inspectors; Andrew Wilson, Pittston Co.; and Robert M. Curry, U. S. Bureau of Mines, for examination and revision.

Proposed revisions in a mine-ventilation code were discussed and approval was given to transmitting the code to the American Standards Association with the proviso taht it would stand approved if the proposed changes were made. Members also approved a resolution that all coal mines producing coal for sale or trade, irrespective of the number of employees, should be brought under the mine laws of the respective States and that all such mines should be located on maps showing the mine workings, copies of such maps to be furnished the State inspection departments. Pittsburgh was selected as the site of the 1939 meeting.

Safety should rest on a study of humanity, declared Eugene McAuliffe, president, Union Pacific Coal Co. In his opinion, too much stress had been laid on working methods by operating and inspection men and the technical press. For best results, injuries should be measured in terms of man-hours of exposure to give proper effect to the increasingly important part played by the machine and less stress should be laid on fatalities. Equal weight should be given to every injury, whether fatal or not. The way to reduce compensation cost is to stop accidents rather than quarrel with injured men or dependents over the exact sum they should receive.

Intensive Program Started in 1915

Mr. McAuliffe's company undertook to expand its accident-prevention work on an intensive basis in 1915, "the management taking the position that, inasmuch as it undertook to provide leadership in all matters relating to production, an even greater responsibility demanded positive evidence of leadership in accident prevention." In 1923, a Book of Standards governing safety work was prepared. Between 1923 and 1932, inclusive, a total of $1,019,176.35 was expended on special safety payrolls and safety material, and in addition to a comprehensive list of physical safeguards, first-aid training, protective clothing, safety awards, methods of stimulating the competitive spirit and a number of indirect promotional activities were adopted. In the same period, the mines were converted from mixed hand and mechanical to full mechanical loading and black powder was eliminated.

Results in the first ten years, however, were none too encouraging. In the period 1923-27, man-hours per injury (fatal and non-fatal) were 15,617, rising to an average of 16,329 in the period 1928-32, inclusive. It was only in the five-year period 1933-37 that an acceptable measure of progress was made, with the result that average man-hours per injury rose to 61,165. Extraction per acre mined has increased from approximately 60 to 90 per cent, largely due to the speed possible with mechanical loading, while the cost of workmen's compensation per ton dropped materially to but 64.2 per cent of the first five-year period in the period 1933-37 and to 51.8 per cent in the year 1937, or 1c. per ton in awards to men and dependents.

"The situation behind our failure to make a material improvement in the first ten years might be set forth in a very few words. We found that the standardized form of safety campaign, even when supplemented by a heavy expenditure of money, seemingly did not enter into the souls of a great number of our employees." The improvement in the last five years

was the result of recognition of "the natural inclination toward chance-taking that saturates many mine workers. . . . It occurred to us that if it were possible to transfer the field of chance taking from the mines to a well-lighted and comfortable room, with prizes to be awarded through established methods, the names of those eligible to be placed in capsules, which were thereafter to be placed in a glass bowl to be drawn by a blindfolded child, the novelty of the situation might bring about the results we had in mind."

Following out this thought, two automobiles were drawn for in 1931. The response was immediate, and, while the prizes have been varied from time to time, a steady reduction in the number of injuries has occurred since July 1, 1931. In 1937, man-hours per injury increased to 92,680, with a further rise to 121,838 in the first quarter of 1938, in which no fatalities occurred.

"Out of our fifteen years' experience in intensive safety work," said Mr. McAuliffe, "the management has arrived at the conclusion that the attitude of mind and the habits of men, whether mine workers or professional men, cannot be changed in a day, a year or even five years. . . . A combination of persistent effort, plus the willingness of the management to assume the fullest responsibility of leadership, coupled with a further attraction for the mine employees in the form of material award, will bring about results if persistently maintained."

Rising to give strong support to Mr. McAuliffe's views on the place of management in safety work, Mr. Ryan contended that safety cannot be delegated by the higher officials; that is, while they may not do the actual work, they must supply the incentive and exercise constant supervision if results are to be obtained.

Chow time for inspectors and conventioners at Buckheart

Making Electricity Safe

Safe installation and maintenance of electrical equipment underground was the theme of an address by N. P. Rhinehart, chief, West Virginia Department of Mines, with John F. Conrad, inspector of electrical equipment, bituminous division, Pennsylvania Department of Mines, leading the discussion. While electricity, introduced about 50 years ago, has contributed much to efficient mining, said Mr. Rhinehart, the simplicity of its use has fostered carelessness, with consequent loss of life and property damage. Major hazards, in addition to shock, are initiation of explosions and fires and the premature ignition of explosives. The first consideration in a safe electrical system is making all initial installations in accordance with approved standards, as once a poor installation is in place, subsequent maintenance will not result in an improvement. And when a good installation is made, subsequent maintenance is facilitated.

Ignition of gas and dust by electrical equipment has been termed a "potential" hazard, said Mr. Conrad, and in many cases rightly so because of certain factors tending to preclude such ignitions, such as adequate ventilation, careful handling of gas, the use of permissible equipment, etc. But makeshift installation and operation convert "potential" to "actual" hazards. An example of makeshift operation is nipping. Systematization of electrical work and education of employees in the principles, care and use of electrical equipment will go far toward making electricity safer.

Many specific recommendations designed to improve electrical safety underground were submitted by Messrs. Rhinehart and Conrad, starting with lightning arresters and breakers on the outside. Trolley and feeder lines should be installed well outside the rails on substantial hangers close enough to keep sag within limits. Both trolley and feeder should be on the same side of the opening and should be guarded or protected when less than 6½ ft. over the rail, over partings where a trolley wire runs between the two parting tracks, over man-trip loading stations and at all points where men must cross under the wire. Provision should be made for cutting the power off the wire when men are boarding or leaving trips at man-trip stations. Contact with doors, coal, timbers and other combustible material also should be prevented.

Power wires should not be extended beyond ventilation, should be properly dead-ended without sharp ends, should be fitted with proper splicers and should be equipped with frogs properly placed (in the case of trolley wire) wherever branches are taken off. Each branch circuit should be equipped with an automatic reclosing circuit breaker, a safety switch which can be opened under power or at least a sectionalizing switch. Both speakers expressed a preference for automatic breakers as the best means of isolating trouble and preventing fires in cases of dead shorts.

Where it is necessary to take high-voltage current underground, cables should be selected for good insulation and high resistance to mechanical injury. Protection against accidental injury should be provided, usually by burying the cable in a trench filled with incombustible material in a non-haulage opening, although the cable may be suspended from the roof in places where the bottom tends to heave. Each conductor should be surrounded by a shielding tape in contact with a ground wire. Junction boxes should be placed in a fireproof vault equipped with a locked steel door. All a.c. and d.c. circuits, including returns, should be kept entirely separate. Individual circuits for lights should be fused, and all circuits should be equipped with, as required, fuses, circuit breakers, lightning arresters and low-voltage releases. All circuits also should be the proper size to prevent excessive heating.

Telephone wires should be insulated and fused, but if bare should be kept well away from power wires. Insulating mats or platforms should be used with all telephones, power switches and other electrical apparatus which men must operate. Voltages of over 250 for circuits serving operating equipment should be discouraged. Good connections to equipment are an essential safety factor.

How to Choose Cables

Trailing cables should be selected with an eye to size, character of the insulation and resistance to external injury. Fuses should be used near the power connection, in addition to fused connections at the machines. Cables on cutters, loaders, etc., should be inclosed in hoses at the points where they enter the equipment. Cable splices in all cases should be as good from the insulation and electrical standpoints as the original cable.

All electrical apparatus should be fitted with a separate ground wire in addition to the regular ground wire to prevent shock in case of trouble. Good returns are essential, which means sufficient bonds of the right size applied in a workmanlike manner. Without good bonding, even insulated couplings will not always prevent shock to men riding in or touching cars or other haulage equipment. Good bonding also is an economy measure. Underground substations should be fireproof and should be equipped with doors that close automatically in case of fire. A separate air current also should be provided, along with extinguishers, sand or rock dust. Provision also should be made to prevent the spreading of transformer oil in case of destruction of transformers. Hoists and similar electrical installations underground also should be located in fireproof rooms.

Locomotives should have a good insulated seat, with shields on the bottoms of the controllers. Men should not be allowed on the top of a locomotive and means should be provided to prevent shock when

(*Turn to page* 100)

Read what users say about---

CARDOX

'The Non-Explosive Mining Method'

"SHOWS GREATER NET REALIZATION"

Detroit Mining Company

DOROTHY-GORDON COAL

Columbus, Ohio

16 EAST BROAD STREET

September 23, 1937.

Safety Mining Company,
307 No. Michigan Ave.,
Chicago, Illinois.

Gentlemen:

We feel that you will be interested in knowing the results we have had with the use of CARDOX.

We are using CARDOX 100% at our DOROTHY GORDON Mine No. 2, which is in the Coalburg Seam, which will average 44" in thickness. This mine is 100% conveyor loading.

Prior to December 1936, with the use of pellet powder, our coal, while somewhat firmer than other coals in this field, was not much above the average in preparation and the percentage of output averaged as follows:

2 3/4"	Nut and Slack	42.29%
2 3/4" x 5"	Egg	22.25
5"	Block	35.46

As the result of a powder explosion in December 1936, which killed two men, we changed over to permissible explosives and as a result, our preparation suffered very materially in increased fines and degradation. As a matter of fact, early in 1937, when we were 100% on permissible explosives, the percentage of our output averaged as follows:

2 3/4"	Nut and Slack	50.58%
2 3/4" x 5"	Egg	21.47
5"	Block	27.95

This tremendous increase in the output of fines coupled with the many complaints we were receiving on increased degradation, prompted us to investigate the use of CARDOX and in June 1937, we began the use of CARDOX 100%, after which complaints on soft structure and excessive degradation in transit and handling was completely eliminated. Not only this, our percentage of output is averaging as follows:

2 3/4"	Nut and Slack	31.27%
2 3/4" x 5"	Egg	17.69
5"	Block	51.04

These figures according to present day selling prices, show an improvement in the net realization with the use of CARDOX of 17¢ per ton over pellet powder, and 29¢ per ton over the use of permissible explosives. Furthermore our tonnage per man has been substantially increased. This because of the fact, that CARDOX has the tendency to roll the coal forward from the working faces for easy loading.

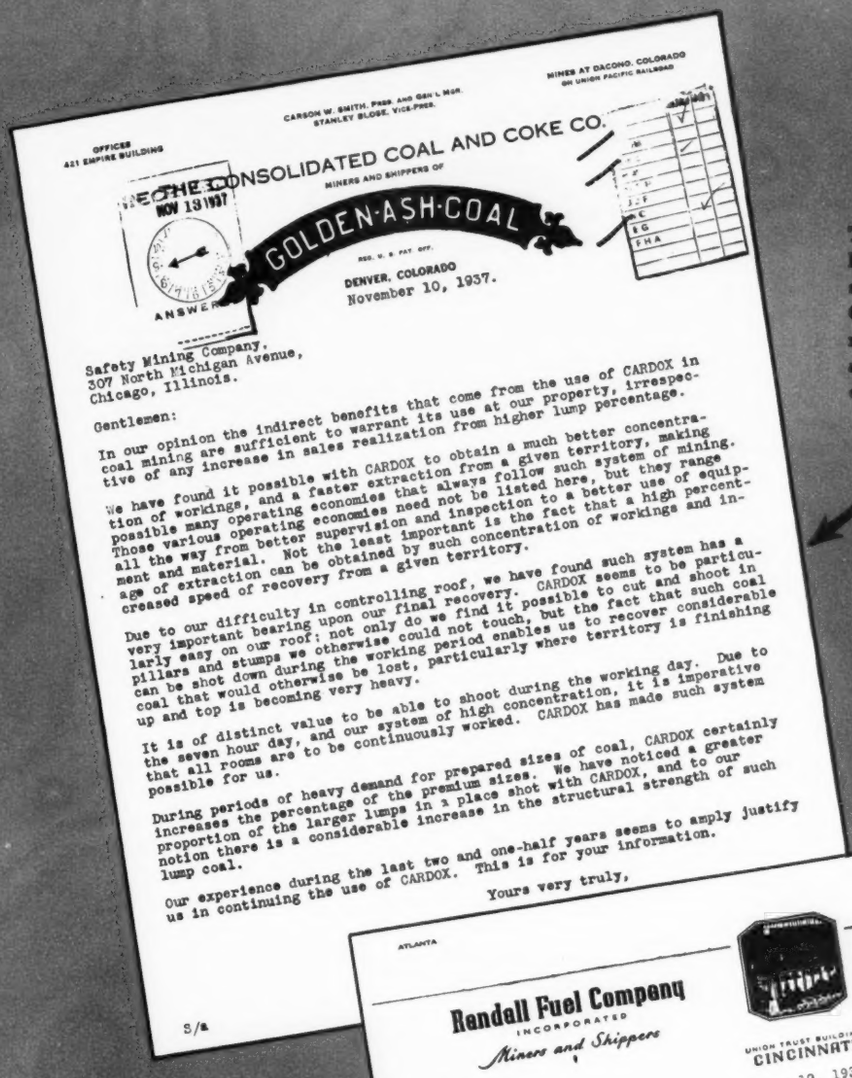
We are well pleased with the results we have obtained from the use of CARDOX and the cooperation and service rendered by your engineers.

Yours very truly,

Fred Bessett

President.

E/S.



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CARSON W. SMITH, PRES. AND GEN'L MGR.
STANLEY BLOSE, VICE-PRES.

MINES AT DACONO, COLORADO
ON UNION PACIFIC RAILROAD

CONSOLIDATED COAL AND COKE CO.

MINERS AND SHIPPERS OF

GOLDEN·ASH·COAL

REG. U. S. PAT. OFF.

DENVER, COLORADO
November 10, 1937.

RECEIVED NOV 13 1937 ANSWERED

Safety Mining Company,
307 North Michigan Avenue,
Chicago, Illinois.

Gentlemen:

In our opinion the indirect benefits that come from the use of CARDOX in coal mining are sufficient to warrant its use at our property, irrespective of any increase in sales realization from higher lump percentage.

We have found it possible with CARDOX to obtain a much better concentration of workings, and a faster extraction from a given territory, making possible many operating economies that always follow such system of mining. Those various operating economies need not be listed here, but they range all the way from better supervision and inspection to a better use of equipment and material. Not the least important is the fact that a high percentage of extraction can be obtained by such concentration of workings and increased speed of recovery from a given territory.

Due to our difficulty in controlling roof, we have found such system has a very important bearing upon our final recovery. CARDOX seems to be particularly easy on our roof; not only do we find it possible to cut and shoot in pillars and stumps we otherwise could not touch, but the fact that such coal can be shot down during the working period enables us to recover considerable coal that would otherwise be lost, particularly where territory is finishing up and top is becoming very heavy.

It is of distinct value to be able to shoot during the working day. Due to the seven hour day, and our system of high concentration, it is imperative that all rooms are to be continuously worked. CARDOX has made such system possible for us.

During periods of heavy demand for prepared sizes of coal, CARDOX certainly increases the percentage of the premium sizes. We have noticed a greater proportion of the larger lumps in a place shot with CARDOX, and to our notion there is a considerable increase in the structural strength of such lump coal.

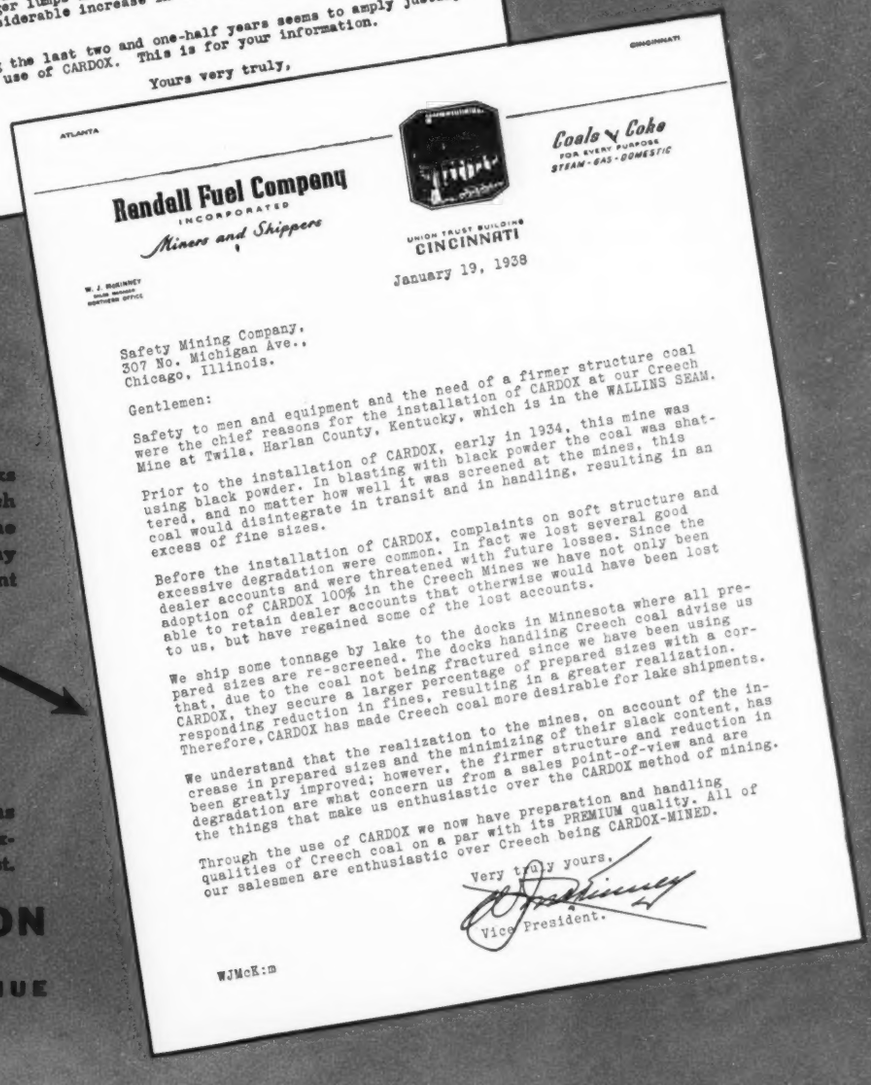
Our experience during the last two and one-half years seems to amply justify us in continuing the use of CARDOX. This is for your information.

Yours very truly,

S/s

"CARDOX IS EASY ON OUR ROOF—"

The letter from Mr. Carson W. Smith brings out a CARDOX feature that should interest every operator. CARDOX is not only easy on the roof, but makes it possible to cut and shoot in stumps that otherwise couldn't be touched.



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Coals ∨ Coke
FOR EVERY PURPOSE
STEAM · GAS · DOMESTIC

UNION TRUST BUILDING
CINCINNATI

W. J. McKINNEY
MAIN MINES
NORTHERN OFFICE

January 19, 1938

Safety Mining Company,
307 No. Michigan Ave.,
Chicago, Illinois.

Gentlemen:

Safety to men and equipment and the need of a firmer structure coal were the chief reasons for the installation of CARDOX at our Creech Mine at Twila, Harlan County, Kentucky, which is in the WALLINS SEAM.

Prior to the installation of CARDOX, early in 1934, this mine was using black powder. In blasting with black powder the coal was shattered, and no matter how well it was screened at the mines, this coal would disintegrate in transit and in handling, resulting in an excess of fine sizes.

Before the installation of CARDOX, complaints on soft structure and excessive degradation were common. In fact we lost several good dealer accounts and were threatened with future losses. Since the adoption of CARDOX 100% in the Creech Mines we have not only been able to retain dealer accounts that otherwise would have been lost to us, but have regained some of the lost accounts.

We ship some tonnage by lake to the docks in Minnesota where all prepared sizes are re-screened. The docks handling Creech coal advise us that, due to the coal not being fractured since we have been using CARDOX, they secure a larger percentage of prepared sizes with a corresponding reduction in fines, resulting in a greater realization. Therefore, CARDOX has made Creech coal more desirable for lake shipments.

We understand that the realization to the mines, on account of the increase in prepared sizes and the minimizing of their slack content, has been greatly improved; however, the firmer structure and reduction in degradation are what concern us from a sales point-of-view and are the things that make us enthusiastic over the CARDOX method of mining.

Through the use of CARDOX we now have preparation and handling qualities of Creech coal on a par with its PREMIUM quality. All of our salesmen are enthusiastic over Creech being CARDOX-MINED.

Very truly yours,

Vice President.

WJMcK:m

"CARDOX MAKES COAL MORE DESIRABLE FOR LAKE SHIPMENTS"

The letter from Mr. W. J. McKinney speaks for itself. Just as CARDOX has made Creech coal more desirable for lake shipments—the CARDOX method of mining can help any mine deliver firmer, better coal at distant points.

●

These letters set forth a few of many reasons why it pays to use CARDOX—the non-explosive mining method . . . Details on request.

CARDOX CORPORATION

Formerly Safety Mining Co.

307 NORTH MICHIGAN AVENUE

CHICAGO, ILLINOIS

the machine is standing on sand. Timbermen and others working around or under power wires should be provided with portable guards. Shots should never be fired from power or lighting circuits. Other recommendations not here listed completed the presentations of Messrs. Rhinehart and Conrad.

"In order to continue the use of electricity in mining," contended P. F. Nairn, deputy secretary, bituminous division, Pennsylvania Department of Mines, in discussing means of preventing electrical ignitions of explosive gases, "we are faced with the problem of making mines safe for its transmission and use by intelligent and timely planning, by installing the correct type of equipment, by frequent examination of and maintenance of such equipment in permissible condition, by assuring an adequate and well-trained official force and by having frequent and searching examinations made for gas."

In gaseous mines, the full-retreat system should be used and operations should be conducted so that sudden outbursts of gas are eliminated. But perhaps the major measure, if ignitions of gas are to be avoided, is adequate ventilation. Trolley locomotives are credited with being the source of ignition of many mine explosions and consequently their use was restricted by the 1937 session of the Pennsylvania Legislature, which also prescribed measures to assure a continuous current of air through that portion of the mine in which the locomotive operates. Open-type equipment of any kind was forbidden in gaseous workings, and the use of rock dust and water was required under certain conditions to localize the effects of gas ignitions.

Proper Supervision Stressed

Proper supervision and a sufficient number of supervisors to insure against dangerous accumulations of gas were stressed by Mr. Nairn, along with a "system of reporting that assures that those in authority shall become possessed with the knowledge of the existence of gas promptly in order that its removal shall be prompt and effective, such removal to be made a matter of permanent record."

If ventilation is ample to dilute, render harmless and carry out gas; if mines are thoroughly and conscientiously firebossed and if nothing but good, well-maintained permissible equipment is used, there will be, without doubt, few or no electrical explosions, said C. A. Herbert, supervising engineer, Vincennes Station, U. S. Bureau of Mines, in discussing Mr. Nairn's conclusions. Mr. Herbert was inclined to give ventilation first place in preventing gas ignitions and at the same time pointed out that good ventilation also meant economy for the operator.

While open lights have been charged with many ignitions, it is quite probable that in many of the cases the gas eventually would have been ignited by open electrical equipment. Consequently, it becomes a question of not only getting after open lights but also supplementing this with the installation of permissible equipment kept in a permissible condition. Turning to mechanization, Mr. Herbert made the point that while loading machines and auxiliary equipment result in some additional hazards, they at the same time reduce the open area in operation, result in improved ventilation and require far better supervision—all these factors tending to promote safety.

Electricity can directly cause injuries only by burning or shock, declared Edward Flynn, safety inspector, Tennessee Coal, Iron & Railroad Co., in making the point that if dust or gas were not allowed to accumulate, many of the so-called electrical injuries automatically would be eliminated.

Safety practices in the Illinois coal fields were summarized by Leonard Forester, mine inspector, Illinois Department of Mines and Minerals. In addition to safety regulations applicable specifically to deep mines, Mr. Forester presented a number of recommendations for safe operation of strip pits.

Electrical systems at strip mines should be carefully watched, he declared. "All operating machines should be properly grounded; cut-out switches should be installed on all lines near the men at work and these switches must always be in good working order; all transformers should have proper protection and all loose ground cables should be protected from trucks and other machines which might be working in the field. Large cables always should be handled with a "hot stick" and never with the bare, or even gloved, hands. It is good practice to have cables hung on movable tripods to enable men and trucks to pass under them. Where conveyors are in use, special effort should be put forth to prevent men from falling into them, into the conveyor chutes or in any manner coming into contact with the machinery.

"Men should never be permitted to step over unguarded machinery. Bridge travelways should be provided . . . and if conveyor chutes are installed on foundations, the bottom should be taken up so that men may pass beneath the chutes. . . . Spoil banks and the high wall, particularly where the stripping is deep, should be watched carefully for overhanging rocks or slides; serious trouble has resulted from the neglect of this important safety measure. Where shooting is done on the overburden, a signal should be given before shots are fired. Explosives of whatever type should be carefully guarded. Storage boxes always should be carefully labelled as required and only a sufficient quantity of explosives for one day's run should be permitted in the pit at any one time.

"Liquid-oxygen plants and all explosives-storage buildings should be set at a distance from tipple and other buildings. The stacks of all coal-burning locomotives should be screened to prevent sparks being carried to men handling explosives. 'No-smoking' signs should be posted prominently at points where explosives are stored or handled and no-smoking rules should be rigidly enforced."

Other important measures are: proper grounding of all transformers, fusing of all high-voltage lines where they enter the property, lightning arresters on all shovels and good installation of power cables. Truck roads, if used, should be wide, and drivers should obey all traffic regulations. Truck roads should be oiled or sprinkled if dust is a hazard. Extreme caution should be used in firing shots, particularly close to a town, village or habitable dwelling. In many cases, serious complaint has arisen, "and aside from the possibilities of damage to property to be considered . . . there is, of course, the ever-present danger of injury or death."

Best methods of keeping the supervisory force up on safety was the theme of the morning session June 8, with D. Harrington, chief, health and safety branch, U. S. Bureau of Mines, as the keynoter. Stressing the fact that operating companies and their managements are finding it politic and even necessary to embark on safety work, Mr. Harrington also emphasized securing the cooperation of employees as a necessary prerequisite to progress. "The best method available seems to be a well-worked-out plan of education through the agency of ample, efficient supervision and drastic but just discipline."

Must Maintain Discipline

Full power to visit disciplinary measures on workmen who are slow to carry suggestions into effect or who refuse to obey should be vested in mine officials, but harshness should be employed only as a last resort. "The kind of discipline that supervisors should use . . . is that of education," but they should learn before they try to teach.

First among Mr. Harrington's recommendations for organizing the supervisory force and keeping it informed on safety procedure to enable it to obtain and hold the cooperation of the worker was that every mine, large and small, should have an active and constantly functioning safety organization, preferably led by the heads of the operating organization and providing for regular safety meetings and a system of investigating all accidents, whether trivial or otherwise. Every mining company, also, should educate its workers and bosses in safe and efficient mining practices and methods. Well-in-

Institute Leaders

J. J. Rutledge, chief mine engineer, Maryland Bureau of Mines, was elected president of the Mine Inspectors' Institute of America at the 29th annual meeting. Dr. Rutledge succeeds Richard Maize, Pennsylvania State mine inspector. Other officers were chosen as follows:

Vice-presidents—Thomas Allen, chief inspector of coal mines for Colorado; James McSherry, director, Illinois Department of Mines and Minerals; and N. P. Rhinehart, chief, West Virginia Department of Mines.

Secretary—C. A. McDowell, personnel director, Pittsburgh Coal Co.

Assistant Secretary—J. J. Forbes, supervising engineer, safety division, U. S. Bureau of Mines.

Treasurer—C. J. Rowe, Maryland State mine inspector.

Emeritus Editor-in-Chief — James T. Beard, Danbury, Conn.

Editor-in-Chief — James W. Paul, Pittsburgh, Pa.

Publicity Editor—R. Dawson Hall, engineering editor, *Coal Age*.

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SUPERLA GREASE

stops motor bearing failures

on ventilator

● Bearing failures in a motor-driven blower at a central states mine, were so frequent that it was necessary to keep a reserve motor in readiness at all times to replace the burned out unit. In addition to the high labor and material expense for replacing these bearings, grease consumption was excessive.

Finally, a Standard Lubrication Engineer was consulted. He carefully analyzed the operating conditions—temperatures, speeds, bearing pressures, etc. First came a thorough cleaning of the bearings. Then Superla Grease No. 2X was applied. Since that day *not one bearing has been replaced,* temperatures have remained normal, and grease consumption has been unusually low.

Standard's line of Superla Greases, correctly applied, will meet practically all anti-friction bearing lubrication requirements with a definite saving in maintenance and lubrication costs. Let a Standard Lubrication Engineer demonstrate this fact on one or more of your particularly difficult lubricating jobs. It will cost you nothing. Just call your local Standard Oil (Ind.) office or write 910 S. Michigan Ave., Chicago, Ill.

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TO REDUCE COSTS

formed officials are necessary if a good job of educating workers is to be done.

There should be one supervisor for about every 25 men always on the job, and experience has shown that these men are not necessarily an additional expense. Every mine should have in printed form the minimum safety requirements of the management, with provisions for revision as necessary. Printed, mimeographed or multigraphed safety messages distributed regularly to every employee and supervisor are an excellent educational medium. Operating companies should secure the cooperation of State and county mine inspectors, and should provide for official attendance at safety gatherings in and out of the State.

Training in first aid is one of the cheapest, easiest and most effective methods of promoting safety mindedness. Such training should be extended to all persons above and below ground, including supervisors. Safety contests between mines or departments are an excellent method of stimulating interest, as well as giving rewards or bonuses for good work in accident prevention. In addition, "every mining company, large or small, owes it to itself, to its employees and in a large measure to the public to see that all employees shall be given a rigid physical examination before employment, as well as at intervals of not to exceed one year during employment."

Protective Clothing Essential

Protective clothing is essential to a well-conducted safety program. Also, "every coal-mine operator and employee should recognize that there is a definite hazard of fire or explosion in any and every underground coal mine and even in some open-pit coal mines. Every mine should have a fire-prevention and fire-fighting plan and a well-thought-out procedure for preventing explosions and handling them adequately if they should occur." The ever-increasing use of electricity introduces new fire and explosion hazards, and consequently the "utmost care should be taken in the purchasing, installation, use and maintenance of all electrical equipment or devices. . . . At least as frequently as once a month a competent electrician should make a rigid inspection and a written report of the condition of all electrical wiring, machinery, etc., in or around every mine, and prompt action should be taken to follow his suggestion for keeping such installations in safe condition at all times."

Too-frequent explosives accidents point to a need for the "greatest care in the choice of explosives and in their storage, transportation, charging and firing. Only explosives and explosives appurtenances of the safest types should be used. Certainly no form of black blasting powder should be allowed in any underground coal mine for any purpose at any time." Before employees are asked to take part in a safety campaign, the company first should put its own house in order. Finally, mining institutes are an excellent method of keeping mine officials informed on current safety developments.

"Safety in mining," Mr. Harrington continued, "cannot be brought about merely by money expenditures . . . although judicious expenditures showing the good intention of the employer are a help. Human nature is such that men will exert maximum effort when personal gain accrues to them for work well done, and there is absolutely no doubt that in many cases maximum safety follows the bestowal of some form of reward and more especially some personal reward for good safety accomplishment. This applies not only to officials but to individual workers as well."

Lauding the safety institutes in Kentucky, A. D. Sisk, safety director, Big Sandy-Elkhorn Coal Operators' Association, declared that the burden of safety promotion falls primarily on the foreman who visits the worker at the face. Consequently, he should keep up with the times and demonstrate his sincerity and should be backed by positive demonstrations of interest by his superiors. And where penalties for bad injury records are provided, they should be accompanied by rewards for good records. Fatalities should not be overstressed, as the goal is elimination of all injuries.

Pointing to a record of 620,000 tons per fatality in May, 1938, compared with 324,000 tons for the State in 1937, H. G. Houtz, special inspector, West Virginia Department of Mines, declared his opinion that experiments and research have provided many instruments for the promotion of safety if they were only fully employed. Failure in many cases is due to lack of a definite program, a fatalistic attitude, a false sense of security or failure to recognize the economic value of safety work. Inspection departments, he contended, should strive for uniform rules applicable to all mines, promote the dissemination of information on hazards and their elimination and support endeavors to secure the cooperation of supervisors and men.

A monthly report listing production and injury figures, analyzing serious injuries and giving helpful hints on safety has been inaugurated in West Virginia and is supplemented by mine foremen's examination guides. These were the forerunners of a new form of mine-inspection report, in pamphlet form, designed to embody a complete list of safety rules and also for making inspection findings as widely known as possible by copies to various company officials in addition to the one left at the mine. Red circles call attention to conditions not in accordance with the rules listed in the report. This report results in uniform inspections, gives definite information on violations of good practice, stimulates inquiry into the reasons underlying the rules, in addition to interest in first-aid and mine-rescue training, and also, by means of wider distribution, places responsibility for maintaining safe conditions on others in addition to the mine foreman.

Any safety program is successful only to the extent that it is understood and accepted, said S. A. Binek, North Dakota State mine inspector, and mine executives cannot expect workers to follow rules and safety suggestions if they do not know what they are. Consequently, supervisors must first inform themselves and then should have the ability to make workmen understand the reasons back of safety work. Furthermore, supervisors should be made to feel that safety is a vital part of their duties and should be provided with sufficient time to carry on this task. Regular safety inspections covering the entire operation should be made and the results made known to all. Concluding his discussion, Mr. Binek suggested the use of part of the Federal "pump-priming" funds in the promotion of mine safety.

Kansas Finds Meetings Help

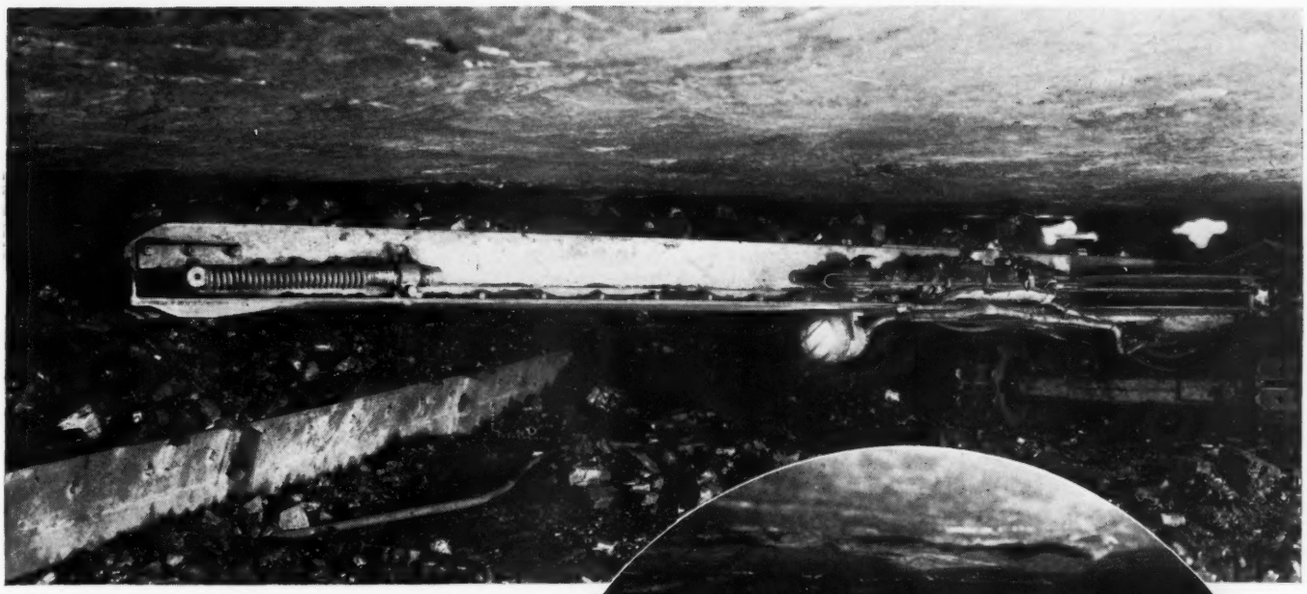
Meetings every three months between inspectors and mine foremen have been found a good method of making the latter more safety conscious in Kansas, declared Dan J. O'Donnell, State mine inspector. The big problem is to get supervisors to accept their responsibilities of guiding the men and setting an example. In Iowa, stated E. A. Farnsworth, State mine inspector, the question is not in getting publicity for safety suggestions but in securing their enforcement. Able supervision, he contended, would have eliminated many injuries. Reducing the supervisory force, lazy supervisors and a non-cooperative attitude on the part of operating companies are among the principal stumbling blocks, along with, in a number of instances, the attitude of the workers. In the latter connection, Mr. Farnsworth expressed the opinion that a possible way of making miners safer would be to assess them for part of the insurance cost.

In response to a question by T. J. Thomas, president, Valier (Ill.) Coal Co., as to what real progress in mine safety had been made in the last ten or fifteen years, Mr. Harrington again called attention to the problem of explosions, which he stated to be growing more serious. But if major explosions could be eliminated, a steady decrease in the fatality rate would result.

Exception to Mr. Farnsworth's suggestion on assessing the miner was taken by Mr. Flynn, who declared that workmen's compensation was adopted not only for payment for injuries but also as a means of penalizing corporations for permitting conditions resulting in injuries. If part of the cost were placed on the employee, it would only relieve management of that much of the penalty and also would compel careful miners to pay for the misdeeds

Coming Meetings

- Greenbrier Smokeless Coal Operators' Association: annual meeting, July 12, Pioneer Hotel, Rainelle, W. Va.
- Southern Wyoming Coal Operators' Association: annual meeting, July 12, Cheyenne, Wyo.
- Pocahontas Electrical and Mechanical Institute: annual meeting, Aug. 18–20, Bluefield, W. Va.
- Sixth annual Illinois Mineral Industries Conference: Sept. 30-Oct. 1, University of Illinois, Urbana, Ill.
- West Virginia Coal Mining Institute: annual meeting, Oct. 7, Charleston, W. Va.
- National Safety Council: Silver Jubilee Congress, Oct. 10-14, Stevens Hotel, Chicago.
- Coal Producers' Association of Illinois: annual meeting, Oct. 11, Springfield, Ill.
- Coal Division, A.I.M.E.; Fuel Division, A.S.M.E., and Western Society of Engineers: joint meeting, Oct. 13-15, Palmer House, Chicago



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of their careless compatriots and the company.

The hazards involved in water collections in abandoned mines was the subject of a paper by John E. Jones, safety engineer, Old Ben Coal Corporation, West Frankfort, Ill. Prefacing his conclusions with detailed descriptions of the flooding of Old Ben No. 18 mine early in 1936 from adjacent abandoned operations with a water-filled area probably in excess of 18,000 acres, and the inundation of certain abandoned and operating mines in Saline County, Illinois, by Ohio River backwater in the flood of January, 1937, Mr. Jones recommended as one of the best precautions against sudden flooding adequate barrier pillars between mining operations.

At Old Ben No. 18, flooding was not directly the result of too-thin pillars but of cutting through pillars from one to another mine without transmitting information to the proper parties or even keeping a record, this making the entire 18,000 acres one body of water. In Saline County, keeping the thin barrier pillars intact prevented flooding of mines adjacent to Sahara No. 3, which was drowned out. Prior to the No. 18 experience, said Mr. Jones, Old Ben officials had recognized the hazard of flooding of the Franklin County field to the north from abandoned Williamson County operations, and had recommended leaving a barrier on approximately the county line. Such a barrier, 300 ft. thick with some exceptions, has been established, and is supplemented by additional barriers with a minimum thickness of 150 ft. around some Franklin County operations.

Meeting Water Hazards

"The potential water hazard from incorrectly mapped or uncharted mines," said Mr. Jones, "increases as greater areas are abandoned and as deeper coal is mined." In the Illinois coal fields, a trifold problem is presented: i.e., "Is the 20-ft. pillar now required by law of sufficient thickness; is adequate attention being given that even this 20-ft. pillar is kept without penetration and fully 20 ft. thick; and are records adequate as to accuracy, as to filing and as to availability for an indefinite length of time?" A 20-ft. pillar provides "too narrow a margin, with the present long cutter bars, to insure that 20 ft. is left," and under Illinois conditions a change to 50 ft. "would be an improvement," with additional thicker pillars to protect areas in which there are several operations. Finally, accurate maps should be made and kept permanently on file, and more attention should be given to the question of encroachment on pillars.

In the discussion following Mr. Jones' paper, S. J. Phillips, State mine inspector, detailed barrier-pillar work in the Northern anthracite field of Pennsylvania, with particular attention to areas along the Lackawanna River; James Berry, chief, Ohio Department of Mines, told of water bursting through under a barrier pillar 17 ft. thick under a 120-ft. head; Mr. Nairn described the case of the St. Vincent shaft in western Pennsylvania in which pumping down water in an adjacent abandoned operation apparently resulted in air causing cutting of the roof and destruction of the 36-ft. barrier, with consequent sudden flooding of St. Vincent; Mr. Maize expressed doubts as to the efficacy of a 20-ft. barrier, remarking that considerably more was required in Pennsylvania, depending upon seam thickness and cover; and Mr. Harrington declared that the flooding possibility is now of greater concern than ever as more territory is worked out and abandoned.

Sudden outbursts of gas in the Berry No. 3 and Kent No. 4 mines in Pennsylvania were described by George J. Steinheiser, State mine inspector. "My convictions," he stated, "are that some of the catastrophes of the past that have gone down in history as due to 'unknown causes' may have been due to sudden outbursts of explosive gases. . . . Personally, I am very much concerned about the possibilities of outbursts taking place in the future."

Ventilation First-Line Defense

The first line of defense is planned ventilation. This in turn involves: (1) adequate and positive air currents; (2) bleeders at the high points on the return side of gob areas to drain gas directly off into the return airways; (3) positive return aircourses controlled by regulators to insure a good supply of air for ventilating pillar workings, at the same time exerting the ventilating pressure against the entire gob line on the active side; and (4) installing power lines and haulage roads on the intake airways. Mr. Steinheiser recommended surveys of their operations by all mining companies to uncover conditions which might favor gas outbursts.

The observation of the previous speaker that many "unknown-causes" explosions might be due to gas outbursts was stressed by J. J. Forbes, supervising engineer, safety division, U. S. Bureau of Mines.

"We Change Bosses"

Effective June 6, Willard T. Chevalier, for the past four years vice-president in charge of McGraw-Hill mining and construction papers, was made vice-president and publisher of *Business Week*. Col. Chevalier has been associated with the McGraw-Hill Publishing Co. for fifteen years and has been intimately connected with the construction industry for more than twice that period. As publishing director of *Coal Age* and *Engineering and Mining Journal* he brought to the job a broad understanding of industrial problems and a sympathetic viewpoint which soon won him a widening circle of friends in the mining fields.

H. W. Clarke, who succeeds him as vice-president and publishing director of the mining group, is no stranger to *Coal Age*. He joined the staff in 1921 as sales manager and continued in that capacity and later also as publishing director until the fall of 1933, when he resigned to become sales promotion manager for Dickson & Eddy. Mr. Clarke returned to McGraw-Hill in 1936 to head up the Atlantic district sales office of the company and subsequently was promoted to regional vice-president.

Uniformity Paramount Need In Stoker Coal

Uniformity of sizing and quality are foremost among the requirements of industrial stoker coal, said E. R. Kaiser, assistant fuel engineer, Bituminous Coal Research, Inc., Battelle Memorial Institute, summarizing the results of field surveys of more than 75 steam plants. Speaking on the problems of industrial steam plants in the use of bituminous coal, at a dinner meeting of the Chief Engineers' Club of the Kalamazoo Valley, held at Kalamazoo, Mich., on June 1, Mr. Kaiser said many improvements have contributed to the satisfactory operation of stokers in recent years. A needed further development, however, is a means of preventing formation of large coke masses in the fuel bed.

The surveys showed that in plants burning pulverized coal the 0x¾-in. size is most popular, but that most plants could use 0x⅜-in. satisfactorily, and that there is a trend in that direction. No difficulty from segregation of coal in handling was reported in pulverized-coal plants. In some industries, approval of dustless treatment of coal is growing.

Easy handling of the coal and comparative freedom from dust were obtained when the moisture content of the coal on receipt was about 4 per cent, but higher moisture contents were not considered seriously harmful. In plants where mills of ample capacity were installed, Mr. Kaiser reported, little stress was laid on securing coal of a high degree of grindability.

Personal Notes

C. R. BOURLAND has been appointed superintendent at the Kopperston mine of the Koppers Coal Co., Kopperston, Wyoming County, W. Va.

JOHN BRADBURN has been promoted from assistant to general mine foreman of the Isabella (Pa.) mine of the Weirton Coal Co. Succeeding Howard Schwenebraten, he assumed his new duties on June 1.

JAMES W. BRISTOW, executive vice-president of the Illinois Reciprocal Trade Association, will resign from that post as of July 1, according to an announcement by S. J. Fowler, a member of the board. Mr. Bristow will leave to become an officer of a newly formed organization of strip-mine operators which will investigate strip-mine legislation.

J. O. BRITT has been made superintendent at Nos. 1 and 2 mines of the Milburn By-Products Coal Co., Milburn, W. Va.

D. L. BROWN has been named superintendent at Helen Nos. 5 and 9 mines of the Koppers Coal Co., Helen, W. Va.

J. F. BUCHANAN has been appointed foreman at No. 2 mine of the Milburn By-Products Coal Co., Milburn, W. Va.

G. M. CAMERON has been made foreman at No. 1 mine of the Milburn By-Products Coal Co., Milburn, W. Va.

G. MURRAY CAMPBELL was appointed coal traffic manager of the Baltimore & Ohio R.R. effective June 3. Joining the company in 1916, he was made assistant

HOW TO *Save Money* ON TIMBERING

Ties, props and timbering treated with Du Pont Chromated Zinc Chloride outlast 5 replacements of ordinary wood.

WHAT IT IS . . .

Chromated Zinc Chloride is an improved wood preservative. It gives essentially the same treatment as zinc chloride with the addition of a mordant which fixes the preservative more firmly to the wood fibre. This reduces leaching and improves its usefulness in wet locations.

WHAT IT DOES . . .

Timber treated with Chromated Zinc Chloride resists decay and is fire retarding. It is clean, non irritating to the skin and has no odor. Above ground Chromated Zinc Chloride has the added advantage of being termite repellent and readily paintable.

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Chromated Zinc Chloride treated timber is used for mine ties, props, timbering, safety doors, tipples, village houses and all other wooden construction both under or above ground.

HOW MUCH DOES IT COST

As an example, treated ties cost approximately ⅓ more than untreated ties. They will last an average of 15 years as compared to 2½ years for ordinary ties.

HOW TO GET THIS TYPE OF TREATED TIMBER . . . . . .

This treated timber is available through the majority of treating plants serving the mining areas.

Write for further information about the advantages of Du Pont Chromated Zinc Chloride and the location of your nearest treating plant.

Specify **TIMBER TREATED WITH . . .**

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Wilmington, Delaware

coal traffic manager early in 1937. He succeeds H. A. COCHRAN, who held the post for the last fifteen years and was connected with the B. & O. coal traffic department for 40 years.

PROF. WILLIAM R. CHEDSEY, director of the Missouri School of Mines and Metallurgy, Rolla, Mo., was granted the honorary degree of Doctor of Engineering at the commencement exercises of the Colorado School of Mines, Golden, Colo., on May 27 for distinguished service in engineering education. He was graduated from the Colorado School of Mines in 1908, practiced engineering for several years, then took up teaching, heading the mining department of Pennsylvania State College for 21 years. He became director of the Missouri School of Mines last September.

R. P. COWAN has been made foreman at the Junior mine of the Red Jacket Coal Corporation, Red Jacket, W. Va.

C. A. GIBBONS, general manager, Susquehanna Collieries Co., is nominee for chairman of the Coal Division, American Institute of Mining and Metallurgical Engineers. His nomination was presented to the board of directors of the institute on June 16.

V. R. HOPE has been named foreman at Douglas No. 5 mine of the Douglas Coal Co., Fireco, W. Va.

GEORGE HOSE has been appointed superintendent at Barbour mine of the George Annese Coal Co., Flemington, W. Va.

D. R. ITTIER has been made foreman at Sked No. 2 mine of the Sked Coal Co., Lanark, W. Va.

A. B. JESSUP, consulting engineer, Scranton, Pa., and L. E. YOUNG, vice-president in charge of operations, Pittsburgh Coal Co., have been nominated for directors of the American Institute of Mining and Metallurgical Engineers.

O. J. MEADOWS has been named foreman at No. 2 mine of the Lorado Coal Mining Co., Lorado, W. Va.

HORACE MOSES, general manager, Gallup American Coal Co., Gamerco, N. M., has been named to succeed the late R. B. Tempest as general manager of the Chino unit of the Kennecott Copper Corporation. Mr. Moses formerly was an official at Chino mines.

A. L. OWENS has been appointed superintendent at Thurken mine of the Imperial New River Coal Co., Winona, W. Va.

PAUL H. PRICE, State Geologist of West Virginia and associate professor of geology, has been advanced to professor and head of the department of geology.

HENRY PRICHARD has been made foreman at No. 5 mine of the Raleigh-Wyoming Mining Co., Edwight, W. Va.

J. W. RICHARDSON has been named foreman at Dubree No. 4 mine of the Maryland New River Coal Co., Nuttallburg, W. Va.

HOWARD SCHWENEBRATEN, formerly mine foreman at the Isabella (Pa.) mine of the Weirton Coal Co., has accepted a similar position at the Nanty-Glo (Pa.) mine of the Heisley Coal Co., effective June 1.

DENNIS SEABOLT has been appointed foreman at Thurken mine of the Imperial New River Coal Co., Winona, W. Va.

C. A. Gibbons

BENJAMIN W. SNODGRASS, president of the Moffat Coal Co., with offices in Denver and operating in Routt County, has announced his candidacy for the Republican nomination for Governor of Colorado.

JOHN WELLS has been named foreman at the Wharton Mine of the Koppers Coal Co., Wharton, W. Va.

HARRY LAVIERS, vice-president, North-East Coal Co., was reelected president of the Big Sandy-Elkhorn Coal Operators' Association at its annual meeting on June 10 at Ashland, Ky. L. C. CAMPBELL, assistant to the vice-president, Koppers Coal Co., was made vice-president; S. B. HOSMER, president, Elkhorn Collieries Corporation, was reelected treasurer, and H. S. HOMAN was renamed secretary.

L. C. WHITE, vice-president, St. Louis, Rocky Mountain & Pacific Co., was elected president of the Colorado & New Mexico Coal Operators' Association at its annual meeting. HOMER H. HARRIS, vice-president, Hayden Coal Corporation, was made vice-president, and F. O. SANDSTROM was renamed secretary, treasurer and traffic manager.

Ten Killed, Five Injured In Hard-Coal Blast

Ten mine workers were killed and five others were seriously injured in an explosion on June 2 in the Butler colliery, operated by the Volpe Coal Co. in Pittston Township, Luzerne County, Pa. Sixteen men were at work in the lowest level of the Red Ash bed when the blast took place, and only one got out safely. The mine was leased by the Pittston Co. early in May to Alexander Volpe, who operates a string of independent collieries.

M. J. Kosik, president, District 1, United Mine Workers, stated that an investigation into the disaster had been started and that union representatives are cooperating with the State Department of Mines and Mining and the U. S. Bureau of Mines in determining its cause. Governor Earle appointed an investigating commission consisting of State Senator Leo C. Mundy, Attorney General Guy K. Bard and Secretary of Mines Michael Hartneady to make an extensive probe of mine safety regulations.

To Start 100 Modern Homes At New Koppers Mine

A contract for construction of the first 100 homes at Kopperston, W. Va., a garden-home village being built by the Koppers Coal Co. for workers near the site of its new mine in Wyoming County, has been awarded to R. H. Hamill Co., Huntington, W. Va. The residences, which will be ready for occupancy late this summer, include 60 four-room structures 24x32 ft. and 40 five-room houses 24x40 ft., each on a lot 40x100 ft. Each also will have a fully equipped modern bathroom and a utility room. There will be twelve varieties of architecture to avoid the monotony of identical dwellings, some

One of the new four-room dwellings to be built at Kopperston

● Whether it is slope hoisting heavy trains of coal from a mine or doing any one of the thousand other things imposed upon it—TRU-LAY Preformed hauls its load a long way. Long continued, uninterrupted service is characteristic of TRU-LAY Preformed. TRU-LAY ropes are superior because they have been preformed. Being preformed every wire and every strand in TRU-LAY is free of tension, relaxed, willing to bend and work as it should. Being preformed TRU-LAY ropes have remarkable resistance to fatigue; they resist kinking, whipping and rotating in sheave grooves. And neither last nor least TRU-LAY Preformed ropes are safe ropes to handle. Send for complete details.

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AMERICAN CHAIN DIVISION
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Weed Tire Chains • Welded and Weldless Chain • Malleable Castings
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Chain Hoists • Trolleys

HIGHLAND IRON & STEEL DIVISION
Wrought Iron Bars and Shapes

MANLEY MANUFACTURING DIVISION
Automotive Service Station Equipment

OWEN SILENT SPRING COMPANY, Inc.
Owen Cushion and Mattress Spring Centers

PAGE STEEL AND WIRE DIVISION
Page Fence • Wire and Rod Products
Traffic Tape • Welding Wire

READING-PRATT & CADY DIVISION
Valves • Electric Steel Fittings

READING STEEL CASTING DIVISION
Electric Steel Castings, Rough or Machined Railroad Specialties

WRIGHT MANUFACTURING DIVISION
Chain Hoists • Electric Hoists and Cranes

In Business for Your Safety

TRU·LAY Preformed WIRE ROPE

ALL AMERICAN CABLE DIVISION ROPES MADE OF IMPROVED PLOW STEEL ARE IDENTIFIED BY THE EMERALD STRAND

having wood siding and others asbestos-shingle siding. There also will be a number of color schemes to provide variety.

Each house will be heated by a coal-fired hot-air furnace installed in the utility room on the first floor, and the furnaces will be equipped with electrically driven fans for force-draft circulation of air. The company will build a central supply system with water piped to the houses. A sewage-disposal system also will be provided. Facing the 20-ft. main street paralleling Toney Fork Creek, there will be a 5-ft. paved sidewalk and a grass plot 15 ft. wide between the lot line and the street.

Commenting on the enterprise, J. P. Williams, president of the Koppers Coal Co., said: "The present state of the coal industry hardly warrants such an expenditure as we are now making, but we are starting this new community and mine because we have faith in the future of the industry and in the future of the nation. By building at this time, we are providing added employment in West Virginia and helping to demonstrate the idea that progressive action now is the stimulus which will lift all business and industry out of the present situaton

—◈—

Plan Carbonized-Fuel Plant In Southern Illinois

Erection of a million dollar plant near East St. Louis, Ill., to convert southern Illinois bituminous coal into a smokeless fuel resembling coke is planned by a firm to be known as the Midwest Smokeless Fuel Corporation, according to an announcement by Smith, Moore & Co., investment brokers, representing the incorporators. The plant will be erected on a 20-acre site between East St. Louis and Belleville, operation to start by the end of the year.

Funds for the venture have been obtained by sale of stock in addition to commitment for a bank loan in conjunction with the Reconstruction Finance Corporation. The loan will be secured by a mortgage on the plant and equipment. The ownership, it is said, will be substantially the same as that of the Radiant Fuel Corporation, West Frankfort, Ill., which has been producing for some time a fuel known as Carbonite (*Coal Age*, November, 1934, p. 421). The new organization, however, will supplement, rather than compete with, the Radiant company.

The new plant is to have a coal washer and twenty Curran-Knowles ovens, and will have a capacity of 75,000 tons of carbonized fuel annually requiring about 118,000 tons of coal. Byproducts will include about 1,000,000 cu.ft. of manufactured gas daily and about 1,500,000 gal. of tar annually. M. D. Curran, one of those for whom the ovens were named, is president of the Radiant organization.

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Permissible Plate Issued

The following approval of permissible equipment was issued by the U. S. Bureau of Mines in May:

Sullivan Machinery Co.: Type 8-A track-mounted mining machine; 50-hp. motor, 220-440 volts, a.c.; Approvals 345 and 345A; May 25.

Safety and Lighting Vie With Coal's Future As Indiana Mining Institute Topics

FACTORS affecting the safety and efficiency of mine employees and the future of coal were the themes of the 1938 summer meeting of the Indiana Coal Mining Institute, held June 4 at the Hotel McCurdy, Evansville, Ind. C. A. Herbert, supervising engineer, Vincennes Station, U. S. Bureau of Mines, and president of the institute, presided. After hearing discussions of safety principles and mine lighting, delegates approved a suggestion by Wesley Harris, president, Bicknell Coal Co., for the appointment of a committee to study the feasibility of inaugurating a training program to instruct coal-mining personnel in handling present-day equipment and production problems. Assistance in this task was offered by A. E. Schoettler, Department of Vocational Education, Indiana State Teachers' College, who outlined programs adopted in other States and territories and discussed the question of vocational training in general. Members of the committee are: Harvey Cartwright, commissioner, Indiana Coal Operators' Association, and institute secretary; Ed Rogers, State mine inspector; P. L. Donie, vice-president, Little Betty Mining Corporation; and Messrs. Harris and Herbert.

"The real reason we strive to prevent accidents is because of our interest in our fellow men," declared H. A. Treadwell, general superintendent, Chicago, Wilmington & Franklin Coal Co., Benton, Ill., in an analysis of the mine officials' part in accident prevention. A second reason is a financial one. Referring to Bureau of Mines Information Circular 6896, Mr. Treadwell pointed to a profit margin of 8.65c. per ton in Illinois with a compensation insurance cost of 4.83c.; Indiana, 7.82 and 4.79c. per ton, respectively; Ohio, 5.53 and 8.64c.; and West Virginia, 6.20 and 3.88c.

"These were the only four States east of the Mississippi River that operated at a profit in the period in question [April 1, 1934–Jan. 31, 1935]. Of the eight remaining States included in this study, six would have been in the black instead of the red had they eliminated the cost of compensation insurance through the elimination of accidents. This shows the vital importance of compensation cost in the industry," even though it does not include the much higher indirect costs growing out of injuries.

"Accidents are preventable. As the accident cost goes down, so does the cost of production. This is not theory; it is the actual experience of a number of mining companies. Accident prevention is only operating a mine in a safe manner. Accident prevention is good mining practice. It means keeping equipment in good operating condition; keeping working places in good condition; and keeping track in good condition so that derailments cannot occur. Accident prevention means the proper placement of employees —the right man for the right job." The ability of a boss to make the proper selection is an important factor in a safety program.

Mental Attitude All-Important

"Safety guards and safety devices should be used where possible. However, if these devices were all successful we would save only about 10 per cent of the average accident cost. Ninety per cent of the direct cost of accidents is the result of the mental attitude of both boss and worker toward safety. We must wake the desire for safety if we are to be successful."

Safety must start with the bosses, Mr. Treadwell contended, and these bosses should be leaders with the ability to teach the men under them. Furthermore, the bosses must be backed by the operating management. Then the cooperation of the workers must be obtained, and one of the best ways of doing this "is through education, efficient supervision and just discipline."

A simple set of safety rules is an essential factor in any safety program. Both injuries and serious accidents in which no injuries are incurred should be thoroughly investigated, the latter with the idea that a recurrence may result in an injury in the future. Adequate records are imperative, and these should include the standing of each boss. Regular exchange of information by all the mines in a field is an extremely helpful step, and should be supplemented by regular meetings of the mine supervisory force at each operation.

Mine officials, contended J. S. Anderson, superintendent, Saxton Coal Mining Co., Terre Haute, Ind., no longer are concerned solely with getting out as much coal as possible regardless of other considerations. They now are persons who understand and can train the men under them in safe and efficient methods of working. To do this they make it their

They Said

Accident cost is the most unpopular figure on the cost sheet. It represents the degree of inefficiency in management.—H. A. Treadwell.

A safe foreman makes a safe workman.—J. S. Anderson.

It seems that during the past ten years the world has become light conscious to a considerable extent, due largely to the rapid development of new and more efficient lighting equipment and the realization that better lighting will increase the capacity, comfort and health of the worker to a very marked extent.—Graham Bright.

Underground illumination still needs to be improved and I hope that supplementary lighting systems will be worked out.—David Ingle, Jr.

The coal industry must seek to increase the efficiency of coal as a fuel so that it will continue to be more economical than oil and natural gas.—A. C. Fieldner.

The Little Red Schoolhouse... in Entry #1

The Shell engineer gave this mine's personnel a schooling in proper lubrication

THE Cahaba Red Ash Coal Co., Inc., of Birmingham, Alabama, operates its mine in single units . . . where the failure of any part of a unit would result in great expense and loss of production.

Experiencing difficulty in lubricating their equipment due to large amounts of water and rock dust, Mr. Z. G. Elmore called a Shell engineer in to survey the company's entire lubrication problem.

After a complete check-up, the Shell engineer recommended the proper Shell Coal-Mine Lubricants for each particular job. But he went further —his study of their problem had convinced him that much of the difficulty was due to improper handling and application of the lubricants. *So he took the mine personnel to school!*

Right on the spot, this Shell engineer conducted a short course in correct lubrication methods . . . showed the miners how each lubricant should be handled and stored . . . how it should be applied to each machine to keep operation safe and efficient.

As a result of this Shell man's enterprise, the Cahaba Red Ash Coal Company is now operating with greater assurance against lubrication failure and *at a reduced cost per ton of coal produced.*

This case history from the Shell files again demonstrates what Shell experience plus Shell products can do to the bogey of "lubrication failure." Whatever your particular problem—call on Shell. Simply write or phone your nearest Shell office.

SHELL COAL MINE LUBRICANTS

business to know their local conditions and the facilities they have to work with, including machinery, transportation equipment, power systems, water, gas, roof, timbering, etc. The present-day official "knows how to protect his men not by words of censure or reprimand but by actual demonstration of methods of avoiding danger, and thus is able to convince his charge that he himself is what he wants the other fellow to be." Rating bosses on the basis of their injury records was urged by F. M. Schull, Binkley Mining Co., Terre Haute.

"The only sure system of providing the miner with adequate, dependable and safe illumination is by means of the electric cap lamp," declared Graham Bright, electrical engineer, Mine Safety Appliances Co., Pittsburgh, Pa., "as this lamp is not dependent on an outside source of power and will give the miner ample and safe light at all times when he is underground." Mr. Bright supplemented his remarks on "Safe Underground Lighting" with a motion picture on the use of electric cap lamps.

Better Underground Lighting

"Accurate illumination measurements can be made readily on the electric cap lamp, and the headpiece of this lamp has been very carefully designed to give the miner the best use of all of the light given out by the bulb. The headpiece and reflector are designed so that all of the light is thrown out in an angle of 130 deg., which is considered the maximum angle that a person can detect light without turning his head. It has been found, however, that the light contained in a total angle of 40 to 60 deg. is all that a person uses, but the light in the outer angles up to 130 deg. gives a person a sense of security, since he is made conscious of any dangerous condition that might arise in these outer zones. It also is found to be very much less fatiguing to the eyes than if there is no light or very little illumination in the outer fields of vision. For the above reasons, the reflector in the headpiece of the electric cap lamp has been designed so that 65 per cent of the total light is given out in the angle of 60 deg."

Tests made by the Electrical Testing Laboratories to determine the light output of carbide lamps were summarized by Mr. Bright, who pointed out that these investigations showed that the reflector on the average carbide lamp remains in good condition for only a very short time, which means that for practically the entire lamp life "all useful light comes direct from the flame, which is continually changing in length. It was found that the condition of the reflector had considerably more influence on the distribution of the light within the angle of greatest usefulness to the wearer than the length of the flame."

Average carbide-lamp flame was found to be practically 1 in. Light output in the 0- to 65-deg. angle was found to be 46 per cent, as compared with 100 per cent for the electric lamp (65 deg. on each side of the center line, or a total of 130 deg.). In the case of the carbide lamp, only 10 per cent of the total light from the average lamp was given out in the working angle of 0 to 30 deg.; compared with 48 per cent in the case of the electric lamp. Summing up, said Mr. Bright, the electric lamp, in addition to decreasing eyestrain by providing a steadier light, gives 3.3 times as much light in the total angle of 0 to 65 deg. and seven times as much in the 0- to 30-deg. zone.

The electric lamp, stated David Ingle, Jr., superintendent, Buckskin Coal Corporation, while more efficient than the carbide lamp, still does not provide sufficient light. Consequently, in his opinion, supplementary lighting should be worked out. In the case of loading and cutting machines, for example, one or two lights placed so that they would shine against the roof and the bottom probably might be found advantageous.

The technical session ended with the showing of a motion picture on the construction of the Golden Gate bridge by the Bethlehem Steel Co. At the evening banquet, with A. U. Miller, U. S. Bureau of Mines, Vincennes, Ind., as toastmaster, A. C. Fieldner, chief of the technologic branch, U. S. Bureau of Mines, Washington, D. C., reviewed the future in the fuels field. Prefacing his conclusions with a detailed review of the part which coal and competitive fuels have played in the the energy markets of the United States, Dr. Fieldner expressed the opinion that any further decline in the use of bituminous coal is unlikely. The future of anthracite, however, is somewhat dubious.

Coal will continue as the principal fuel for public-utility and major industrial-power uses, and with an increasing demand for energy and a decrease in the output of residual fuel oil a trend toward increased coal consumption should be noticeable in ten to fifteen years. Use of smokeless types of fuel will continue to grow, and in this connection no substitute for carbonization has yet been found.

The convenience and automatic features of oil and gas will result in these fuels continuing in favor but stokers eventually will give more economical automatic service. But how the low-income groups will get a smokeless fuel is a question which eventually may be solved by the granting of subsidies to plants by municipalities. Coal, however, because of its low cost, will continue as the principal fuel in this income group. In the railroad field, diesel equipment will continue to gain at coal's expense for the present, although it soon may expect competition from new steam motive equipment now in the process of development. In the marine field, oil will continue to increase because of its form and other bunkering and utilization advantages. As yet, because of cost, United States production of liquid fuels for internal-combustion engines from coal is largely experimental, although as soon as the crude-oil supply begins to diminish new processes will come into the picture to supplement it.

Mechanical Stoker Sales Continue Advance

Sales of mechanical stokers in April last totaled 4,141 units, according to statistics furnished the U. S. Bureau of the Census by 112 manufacturers (Class 1, 53; Class 2, 28; Class 3, 29; Class 4, 20; Class 5, 12). This compares with sales of 3,882 units in the preceding month (the figure given on page 92 of *Coal Age* last month was a typographical error) and 6,082 in April, 1937. Sales by classes in April last were: residential (under 61 lb. of coal per hour), 3,738 (bituminous, 3,379; anthracite, 359); small apartment-house and small commercial heating jobs (61 to 100 lb. per hour), 180; apartment-house and general small commercial heating jobs (101 to 300 lb. per hour), 117; large commercial and small high-pressure steam plants (301 to 1,200 lb. per hour), 60; high-pressure industrial steam plants (more than 1,200 lb. per hour), 46.

Smoke-Prevention Group To Coordinate Efforts

Attended by more than 200 representatives of associations and companies interested in smoke problems, the 32d annual convention of the Smoke Prevention Association, held May 17-20 at Nashville, Tenn., was one of the most successful in the history of the organization. Proposals were made at a conference of air inspectors and members of the standards committee of the association with representatives of the coal and coal-equipment industries to coordinate and consolidate the work of many groups in an effort to determine more effectively a method to establish standards governing installation of equipment, the equipment itself, and proper and reasonable definitions of what constitutes a public nuisance in so far as smoke abatement is concerned.

Representatives of various industries at the conference were: E. C. Webb, chief engineer, Iron Fireman Mfg. Co., and a member of the engineering committee of the Stoker Manufacturers' Association, for the small-stoker industry; C. E. Bronson, chief engineer, Kewanee Boiler Corporation, for the Steel Heating Boiler Institute and Sectional Committee B-50 under the American Standards Association; A. R. Mumford, New York Steam Corporation, for the A.S.M.E. Fuels Division; William Sparrow, Babcock & Wilcox Co., for the American Boiler Manufacturers' Association; and Marc G. Bluth, for the National Coal Association and the Committee of Ten—Coal and Heating Industries.

The standards committee was enlarged to include representatives of organizations and industries having a vital interest in the smoke-abatement problem. In an effort to eliminate duplication of work on standards governing equipment installation, smoke ordinances and other vital factors a procedure was developed which will call upon engineering societies, national associations of equipment manufacturers, and representatives of various coal associations to engage in a series of conferences with the standards committee of the association for the purpose of centralizing activities and to provide impetus to the movement on standardization initiated by smoke inspectors. Tentative standards already proposed incorporate practically every phase of the air-pollution problem and go into such matters as furnace dimensions, boiler ratings, measurements of smoke density and fly ash, and standardization of smoke-abatement ordinances and regulations.

William C. Culbert, chief smoke inspec-

tor of Nashville, was reelected president of the association; Stanley C. Higgins, secretary, New River Coal Operators' Association, was made first vice-president; Harry Carlson, fuel inspector, Nickel Plate R.R., second vice-president; and Frank A. Chambers, Chicago smoke inspector, was reelected secretary-treasurer. W. E. E. Koepler, secretary, Pocahontas Operators' Association, who served as first vice-president for several years, was named chairman of the public service committee.

Form West Kentucky Institute

The Western Kentucky Mining Institute was organized on June 7 at a meeting held at Madisonville, Ky., at which John F. Daniel, chief of the State Division of Mines and Minerals, presided. The organization will hold meetings on the last Tuesday in each month, at which safety and operating problems will be discussed. At the initial meeting these officers were elected: president, W. A. Vinson, superintendent, Hart Coal Corporation; first vice-president, Ray Cobb, mine superintendent, West Kentucky Coal Co.; second vice-president, James Ruckman, Ruckman Coal Co.; third vice-president, Bradley Sparks, foreman, Graham Coal Co.; secretary, Lindsey Cobb, mine inspector, Earlington; and treasurer, C. W. Maloney, Newcoal Corporation.

Obituary

FRANK E. TAPLIN, 62, active for many years as a coal and railroad financier, died June 7 in Cleveland of a cerebral hemorrhage. The chairman of the North American Coal Corporation started his business career as an office boy for the late John D. Rockefeller, became a salesman for the Standard Oil Co. in 1892, later a salesman for the Pittsburgh Coal Co., and in 1901 was made sales manager for the Youghiogheny & Ohio Coal Co. At the time of his death he was chairman of the board of the Pittsburgh Terminal Coal Corporation and president of the Powhatan Mining Co., C. H. Mead Coal Co. and Red Parrot Coal Co. At one time he also was president of the Standard Island Creek Coal Co.

E. L. BERGER, 54, general superintendent of the Bell & Zoller Coal & Mining Co. oprations at Zeigler, Ill., died suddenly May 27. He was stricken while participating in the opening ceremonies at the new Zeigler community house. A graduate of the School of Mining Engineering of Ohio State University, his connection with the coal industry began in St. Charles, Mich. In 1912, however, he formed a mining engineering firm with a schoolmate in southern Illinois. Several years later he joined the Bell & Zoller Coal & Mining Co., working both at Centralia and Vincennes, Ind., at first, but twenty years ago he was transferred to Zeigler.

SAMUEL N. NIELSON COWLEY, 54, superintendent at the Castle Gate mine of the Utah Fuel Co., Castle Gate, Utah, died early last month at a Salt Lake City hospital after an illness of several months. He had been superintendent at the company's Sunnyside mine until last autumn, when he was transferred to the Castle

Gate operation. He had been in the employ of the company for 29 years.

H. H. KALLAWAY, 58, superintendent of Heisley No. 3 mine of the Heisley Coal Co., Nanty-Glo, Pa., died on June 8.

MADISON T. DAVIS, SR., 90, formerly a well-known producer in the Kanawha region, died June 11 at his home at Pence Springs, W. Va. He was one of the organizers of the Cabin Creek Consolidated Coal Co., which he directed from 1900 to 1913, after which he retired.

CHARLES K. GLOMAN, 68, formerly purchasing agent and assistant to the manager of the Susquehanna Collieries Co., died May 29 at his home in Wilkes-Barre, Pa. He had been associated with the company and its predecessors for 50 years, retiring in 1936 because of ill-health.

New Preparation Facilities

ELK HORN COAL CORPORATION, Mine 28, Wayland, Ky.: contract closed with Jeffrey Mfg. Co. for washery addition to existing plant, including a three-compartment Jeffrey Baum jig with dewatering screens, conveying equipment, and water-clarification tank; capacity, 300 tons per hour of 6x$\frac{3}{16}$-in. coal.

MOFFAT COAL CO., Taylor colliery, Taylor, Pa.: contract closed with Menzies Separator Co. for one 10-ft. Menzies cone separator to clean stove coal; feed capacity, 110 tons per hour. Represents an addition to existing equipment.

RED JACKET COAL CORPORATION, Keen Mountain mine, Keen Mountain, Va.: contract closed with Jeffrey Mfg. Co. for washery addition to existing plant, including a two-compartment Jeffrey Baum jig with conveying equipment and dewatering screens, and with sludge tank; capacity, 170 tons per hour of 3x$\frac{3}{16}$-in. coal.

RINGGOLD COAL CO., Timblin, Pa.: contract closed with American Coal Cleaning Corporation for pneumatic coal-cleaning plant, including crushing, picking and loading facilities with capacity of 150 tons per hour of mine-run; equipment includes two American new type "Twin-Dex" separators with American metallic dust-collecting system; cleaning capacity, 120 tons per hour of 0x3-in. coal; also four American anti-gravity screens to separate the cleaned product into five commercial sizes; conveying equipment and structure furnished by Fairmont Machinery Co.; to be completed about Aug. 1.

STEVENS COAL CO., Trevorton, Pa.: contract closed with Wilmot Engineering Co. for complete breaker to prepare coal from the Moulton Bank, equipment to include all conveyor machinery, sizing screens, crusher rolls, Wilmot jig for stove and nut and Hydrotators for pea down to and including Nos. 4 and 5 buckwheat; capacity, 150 tons of feed per hour. To be completed and in operation by Sept. 15.

SUPREME ANTHRACITE COAL MINING CO., Peckville, Pa.: contract closed with the Chance Coal Cleaner for one 12-ft. Chance cone and auxiliary equipment for installation in breaker now under construction. The cone will clean all sizes from buckwheat up at a rate of 165 tons of feed per hour. Installation of the cone and construction of the breaker are scheduled for July completion.

Water With Air From Four Balanced Fans Used to Fight Von Storch Mine Fire

FIRE at the Von Storch mine of the Penn Anthracite Collieries Co., which threatened all the collieries in the vicinity and the city of Scranton above them, was recently extinguished by the united efforts of those companies which were in fear of being injured by its spread, said P. H. Dever, assistant to the general manager, Glen Alden Coal Co., at the annual spring meeting of the Anthracite Section, A.I.M.E., May 21, at the Hazleton Country Club, Hazleton, Pa., with R. Y. Williams, consulting engineer, Pottsville, Pa., in the chair.

Von Storch colliery is on the bank of the Lackawanna River and under the Providence or Northern section of Scranton. Fall of a charged trolley wire apparently caused the grounding of an electric current somewhere between the 12½-deg. slope and the shaft, causing a fire to break out in the mine. The slope gives access to eight beds and extends at the surface to the head of the Von Storch breaker. The fire, which developed in the workings of the Fourteen-Foot bed, here 8 to 9 ft. thick, the fifth seam from the surface and under a cover of 300 ft., was fanned by a current of air which passed down the slope to the workings and thence to the shaft. Only a skeleton force of men was employed, and these were engaged in pumping and maintenance. When smoke began to pour from the shaft, an attempt was made to load out falls 12 ft. high which already blocked the way to the fire.

Because the Penn Anthracite company was not equipped to fight the fire and the Federal Government would not do so because it was on private property, several companies owning the surrounding properties met and undertook its extinguishment. Operations were placed in charge of Mr. Dever. Use of the shaft as a means of approach had become definitely undesirable, if not impossible, as the temperature at that point had reached 180 to 200 deg. F. and the percentage of carbon monoxide 1½ to 2. Hence the first attack under the new management was made from the slope, diverting the air through the Rock bed, where permanence of roadways was assured by the erection of 200 new posts.

Two Buffalo Forge No. 4 fans, 5 ft. in diameter, with V-belt drives, giving a choice of three speeds, were erected in the Fourteen Foot bed. These had two 20-in. pipes; one used as an intake and the other as an exhaust. These two ducts were advanced together 20 ft. at a time, so that their orifices would be always nearly opposite each other on the roadway. Consequently, air entered by one pipe, crossed over and left by the other without putting an unbalanced pressure on the fire. In this way, barefaced men were enabled to play water on the heated material. Air drawn through the exhaust pipe passed to the airways in the Rock bed workings above. If the men went 10 or 15 ft. beyond the ends of the pipes, they entered a deadly atmosphere. An air-lock was built with the exhaust pipe passing through it.

Fire Fighting Resumed

This done, work was started again on the shaft end of the fire with burning timber and falls the main obstacles. Here also two Buffalo Forge No. 4 fans were installed and two 20-in. ducts, enabling an attack to be made at the shaft end of the fire while advances were being made at the slope, where the fire was more severe. In much of the intervening distance, only the timber was burned or burning. A large part of the 14- to 16-in. timber had to be replaced three times, and the air tended to return over the lagging, for the timber sets were well lagged. For this reason, the pipes had to be elevated. In all, 1,357 ft. of straight or sinuous dogholes of required lengths was driven into the coal pillars at the seat of the fire, which in many cases was at a cherry-red heat. Advance into these long dogholes was made possible by placing two 10-in. pipes in each opening connected with the main air pipes. Material was moved in on a ¾-cu.yd. buggy; 2,700 cars of hot coal and débris were pulled out of the mine and 1,300 to 1,400 timber sets placed.

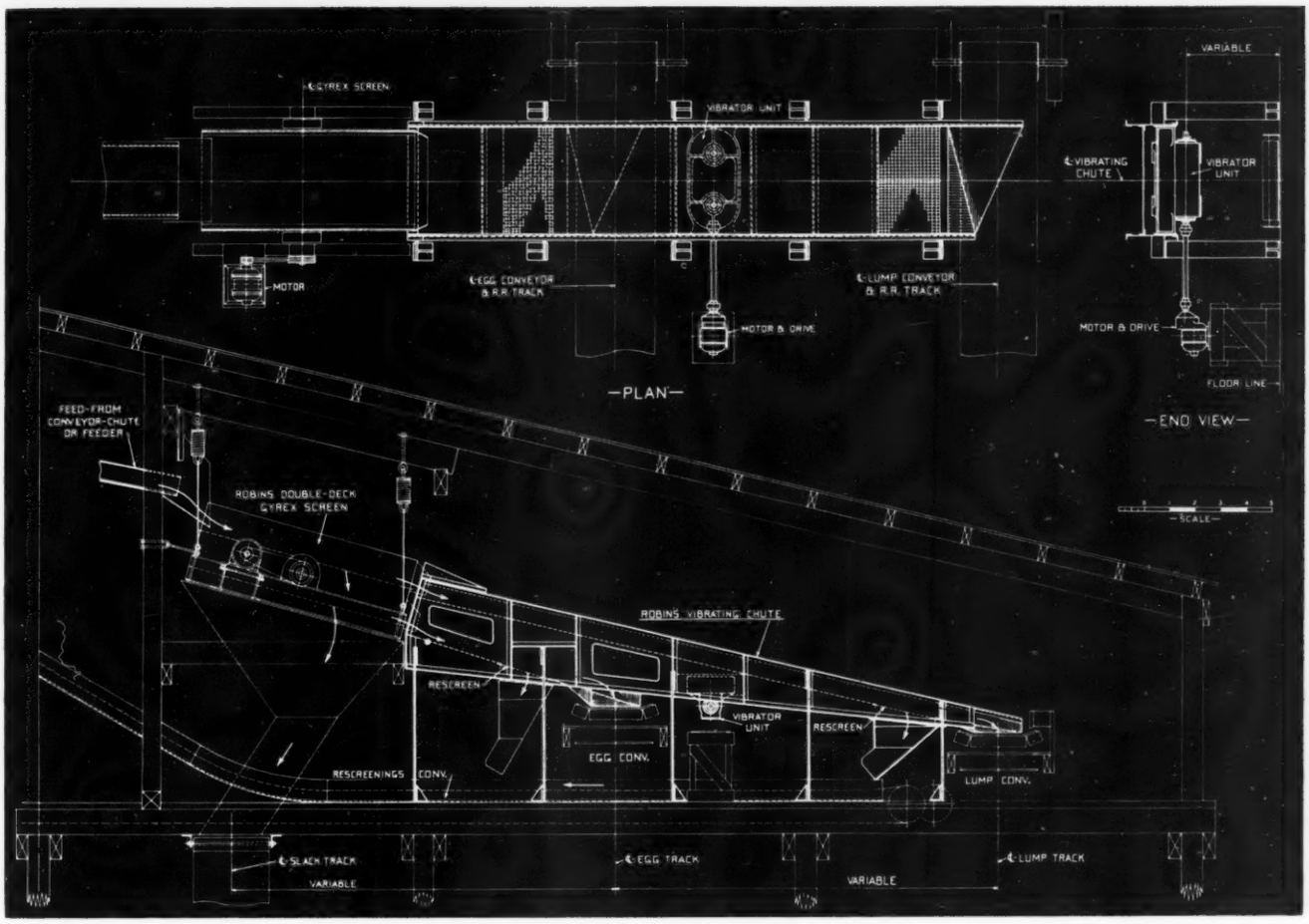
After 55 days of three-shift fighting, the fire was extinguished. A board-and-manure dam was placed below the fire area, so that the water would rise to extinguish and cool the heated embers. In fighting the fire, the principle borne in mind was to keep the pressure equal on the two sides of the fire so that no air would pass over it. During most of the time no analyses of air were made, but close watch was kept of the carbon-monoxide percentage, with the aid of M.S.A. detectors. No compensable accident occurred during the fire fighting.

An ever-present fear was that the electric current would fail and the men would be asphyxiated or poisoned by the gases from the fire and would be prevented from escaping because the cage in the shaft could not be operated in absence of current. The fact that the men were working at times 600 ft. from the shaft would make escape impossible. For this reason, elec-

Broadcasts From Mine

An innovation in anthracite advertising was a broadcast from the Stevens Coal Co.'s mine, at Shamokin, Pa., at a point on the Water Level 1,000 ft. below the surface. This first broadcast from a Pennsylvania hard-coal mine was effected by WKOK, a Sunbury (Pa.) station, May 25 and June 1. Interviews with George Jones, the general manager, and Harry Schrawder, the general inside foreman, were followed by a colloquy with two miners.

In the first interview it was stated that the mines had 35 miles of roadways and 36 telephones. The second broadcast related to mining at the face as described by men at a temporary station there located and another anent the breaker amid its cones and shakers.

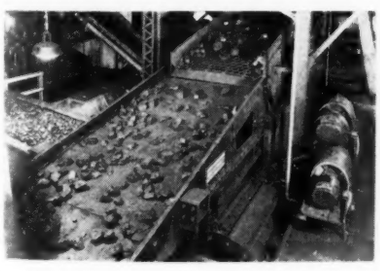


Gentle Travel

ON THE ROBINS VIBRATING CHUTE

(Patent Applied For)

The fore and aft motion of the Robins Vibrating Chute, imparted by the enclosed centrifugal vibrator, moves the coal ahead so gently that it does not cause breakage of sound lumps. It provides an ideal method of transferring coal from primary or secondary screens to picking tables or loading booms. Sections of screen may be provided for cleaning or rescreening during travel. Write for particulars.



The chute has a slight slope and acts as a feeder. Available in single and multi-deck designs.

ROBINS MAKES **all types of Tipple and Mine Conveyors, Loading Booms, Bucket Elevators, Feeders, Crushers, Screens, Gates and Mead-Morrison Hoists, and Grab Buckets.**

MATERIAL HANDLING ROBINS EQUIPMENT

ROBINS CONVEYING BELT COMPANY, 15 PARK ROW, NEW YORK, N. Y.
Please have your representative call ☐.

Please send description of.....

Name.....

Firm .....

Address .....

City..... State.....

tric batteries were provided to operate the fans electrically. These batteries could rotate the fans for six hours without recharge. To provide for the operation of the hoist in case of power failure, a locomotive was stationed near the shaft with steam up to deliver steam to the hoist engine and, as a further precaution, a compressor, actuated by a gasoline engine, was stationed near by to provide compressed air for the operation of the hoist, if need arose.

Each fire-fighting problem, said Mr. Dever, has its own right method of solution. The easy contours in this case favored the method chosen. In heavily pitching beds where a fire occurred in the top of a chute or breast, he had found the use of soda-acid extinguishers quite effective. A discharge pipe would be attached to the timbers, the soda charge inserted and the acid released, provoking a discharge of carbon dioxide. The men operating the machine would leave it, to return later and add another charge; each charge took only three minutes to put in place.

Discussing the fall of wire which caused the fire, E. B. Wagner, chief electrical engineer, Lehigh Valley Coal Co., said that with circuit breakers, the ground thus formed might be insufficient to throw the circuit-breaker switch, but it was his custom in providing current for light loads to introduce a small circuit breaker that would throw a switch if a lesser ground was experienced.

In fire fighting, the importance of watching the barometer, emphasized Mr. Dever, could not be too much stressed. He had found that, with such a fall in barometric pressure, the noxious gases would move down toward the seal, though before the drop the air might be respirable for a hundred or more feet beyond it. Concrete stoppings are permeable to air and other gases. He had never tried the coating of concrete stoppings with lime or paint to make them impermeable, but he had found Paragon wood pulp helpful in preventing such leakage.

Whenever men, complaining about bad air, leave their working places in the Glen Alden Coal Co.'s mines, added Mr. Dever, the officials do not laugh it off as merely the result of a carouse of the previous day. Men are sent in at once to find if anything is really wrong and, in two out of three cases, an incipient fire is found and extinguished.

R. Y. Williams was elected chairman for the ensuing year and H. H. Otto, mining engineer, Hudson Coal Co., vice-chairman, with the following committeemen: W. S. Ayres, J. R. Bazley, Cadwallader Evans, Jr.; B. H. Stockett, F. H. Warner, Edward Griffith, J. C. Haddock, A. B. Jessup, C. A. Garner, C. A. Gibbons, Donald Markle, H. F. McCullough, Paul Sterling, H. D. Kynor, L. D. Lamont, T. D. Lewis and W. H. Lesser.

Safety Teams in Close Finish

In the annual Marion Division (West Virginia) safety meet held by the Industrial Collieries Corporation early in June, the No. 41 mine team won first place in its division and the negro team from Dakota mine No. 42 led in its section. Only 0.1 per cent separated the three highest groups in the white division, and 0.4 per cent separated first and third among the negro competitors.

Dr. Arthur L. Murray, Pittsburgh experimental station, U. S. Bureau of Mines, presented a certificate of honor on behalf of the Joseph A. Holmes Safety Association to W. E. Ball, superintendent of the Dakota mine, which has operated for more than two years without a fatality, producing more than two million tons of coal.

Correcting an Error

In describing the "Flexipipe" ventilating tubing exhibited by Bemis Bros. Bag Co. at the Cincinnati convention-exposition in May (*Coal Age*, June, 1938, p. 63) it was stated that one of the features was "the use of special suspension clamps which will tear off without injuring the tubing." This was an erroneous statement, as the clamp is very securely attached to the rope seam and it is nearly impossible to tear or pull the clamp off. The editors regret that this misstatement should have slipped in.

Alabama Roads Cut Coal Rates

Alabama railroads reduced freight rates on coal from Birmingham to Mobile, effective June 1, from $1.90 to $1.40 per ton to meet barge competition on the Warrior Waterway.

Trade Literature

BELT CONVEYOR IDLERS—C. O. Bartlett & Snow Co., Cleveland, Ohio (Bulletin No. 80, 24 pp., illustrated). Contains complete details of a new line of Timken-bearing-equipped belt idlers.

BUILT-UP ROOFS — Johns-Manville, 22 East 40th St., New York City (36-pp. booklet, illustrated). Gives a complete explanation of the various types of roofing materials and the qualities which determine their ability to stand up under fire, weather and wear; includes over 40 complete detailed specifications and drawings to illustrate the manner in which the roofing materials are applied to various types of roof decks.

CALYX CORE DRILLS — Ingersoll-Rand Co., Phillipsburg, N. J. (Form 9501-A, 42-pp. catalog, illustrated). Describes the company's complete line of Calyx core drills comprising seventeen models for all classes of service.

CENTRIFUGAL PUMPS—Morris Machine Works, Baldwinsville, N. Y. (Bulletin 168, 20 pp., illustrated). Describes pump designs for handling clear water, corrosive mixtures, and the various kinds of abrasive materials, such as coal and sand.

COAL WASHERS—Morrow Manufacturing Co., Wellston, Ohio (6-pp. folder). Sets forth the principles and advantages of the Morrow-Prins multi-flow washer, picturing its operation and typical examples of Morrow equipment.

ELECTRICAL EQUIPMENT—Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Leaflet 2124-A gives data on Type ARZ inclosed, fan-cooled motors designed for use where dust, dirt, acid fumes and moisture tend to shorten the life of motor windings. Bulletin 1190 describes the company's complete switchboard line as well as oil circuit breakers and metal-inclosed switchgear. Leaflet 2289, entitled "Distribution Transformers," gives the outstanding features of 200- and 150-kva. units for small substation service in all commercial voltages. Bulletin 1829-A treats of small electric hoists designed for mine service.

ELECTRIC INSTRUMENTS—General Electric Co., Schenectady, N. Y. "Instruments in Industry" is a new house organ which will be issued periodically by the company's meter division, designed to present and illustrate the many ways in which electric instruments can bring more and greater benefits to industry. Bulletin GEA-2011A points out the advantages of Type AP-9 portable testing instruments in ferreting out leaks that waste power and in pointing the way to worth-while savings. Folder GEA-2635 shows important design features of recording instruments with case history showing help in maintaining uniformity and high quality of products.

EXCAVATOR—American Hoist & Derrick Co., St. Paul, Minn. (Catalog GS3, 24 pp., illustrated). Cites salient characteristics of the Model 350 American Gopher ½-yd. shovel, crane and dragline, giving specifications.

EXCAVATOR — Bucyrus-Erie Co., South Milwaukee, Wis. (Bulletin 29-B, 32 pp., illustrated). Describes the "speedlined" 29-B one-yard excavator; complete specifications give all working ranges and crane ratings.

HIGH-TENSILE, CORROSION-RESISTING STEEL—Bethlehem Steel Co., Bethlehem, Pa. (4-pp. bulletin). Gives origin, history, use, fabrication, chemical composition and physical properties of Mayari R steel, developed to meet a demand for lighter equipment.

LOCOMOTIVES—Goodman Manufacturing Co., Chicago. Bulletin H-378 (24 pp.). Describes and illustrates single and two-motor units of different sizes for gathering cars in mine work. The electric cable reel is discussed at length; information and illustrations of explosion-proof equipment used in the construction of a safety gathering locomotive also are included. Bulletin H-379 (16 pp.) presents both storage-battery and combination trolley and storage-battery locomotives. The units shown are for use in coal and metal mines or in tunnel work.

MINE DRAINAGE PIPE—Johns-Manville, New York (Form TR-20A, 12 pp., illustrated). Gives information on the application of Transite asbestos-cement pipe to the mine-drainage field, explaining how corrosion is resisted and includes weights and dimensions.

POWER-FACTOR REGULATOR — Electric Controller & Mfg. Co., Cleveland, Ohio (Booklet 158, 24 pp., illustrated). Reprinted from *Factory Management and Maintenance*, this brochure is an actual case study showing how the EC&M Co. took advantage of the premium clause for improved power factor in the power

SAVE MONEY IN SCREENING

Two horizontal "Low-Head" Screens saving money by removing undersize coal.

Meet the Increasing Demand for Small Coal without Expensive Changes in Plant Layout

It's easy to get additional screening capacity the "Low-Head" way. You save on elevator height and in power for elevating coal . . . "Low-Head" screens operate horizontally, requiring minimum headroom. Put "Low-Head" screens where you want them . . . hang them from the building structure or mount them on timbers. Either way it costs less to make a "Low-Head" installation.

You can handle more tonnage at less cost with "Low-Head" than with older, slower moving types of screens. The rapid vibrating motion separates the sizes accurately, with minimum degradation . . . Every ton screened saves you money on power costs and on maintenance.

Find out about the possibilities of low cost screening . . . how other plants have saved money. Call your Allis-Chalmers representative in the district office nearest you. Let him show you how "Low-Head" screens will fit into your present installation.

THREE TYPES OF COAL SCREEN

"Aero-Vibe" inclined inertia type
"Style B" inclined positive eccentric type
"Low-Head" horizontal inertia type
Details in Bulletin 1476-A

935

CRUSHING · CEMENT · AND MINING DIVISION

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

company rules and saved about $900 a year.

ROLLER BEARINGS — Norma-Hoffmann Bearings Corporation, Stamford, Conn. (Bulletin No. 962, 8 pp., illustrated). Devoted to precision needle roller bearings and needle rollers; complete data are given as to sizes, dimensions and load ratings of complete bearings.

SMALL PINTYPE INSULATORS — Ohio Brass Co., Mansfield, Ohio (6-pp. folder). Gives catalog information on the complete line of O-B small pintypes, including the standard designs and the multi-ridge units, known as Kingpins.

SOCKET INSTRUMENTS — Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. (Catalog Section 43-600, 20 pp., illustrated). Describes Type E units for outdoor and indoor industrial plants; tabulations and diagrams show styles and list prices.

STEEL BUYERS' GUIDE—Joseph T. Ryerson & Son, Inc., Chicago (224 pp.). Pocket-size booklet gives complete listings and descriptions of the company's wide range of Certified alloy steels and allied products. Included are reference tables, weight charts, standard specification listings, etc.

VARNISHED-CAMBRIC CABLE—Anaconda Wire & Cable Co., New York (Publication No. C-41, 36 pp., illustrated). Presents descriptions, applications, and physical and electrical properties of Anaconda varnished-cambric insulated power cable, showing various types and typical installations.

WHIPCORD V-BELTS—Manhattan Rubber Division of Raybestos-Manhattan, Inc., Passaic, N. J. (Bulletin No. 6868, 4 pp.). Gives technical details of the functions and construction of Condor whipcord V-belts. Photographs of installations, as well as list prices and a V-belt comparison table, are included.

Flames Damage Coal Plants

Fire destroyed the frame tipple of the Butler Junction Coal Co., at Tarentum, Pa., on June 12 causing a loss estimated at $60,000.

A blaze of undetermined origin on May 31 razed the breaker of the Sandy Run Miners & Producers Co., Sandy Run, Luzerne County, Pa., with a loss of about $100,000.

Easy Ash Removal Explained

Publication of an eight-page bulletin entitled "Gravity Ash-Removal Methods," which presents a number of tested methods for convenient collection of ashes from heaters, furnaces, water heaters, cooking ranges and fireplaces, is announced by Anthracite Industries, Inc. Prepared by the Anthracite Fellowship of the Mellon Institute of Industrial Research, Pittsburgh, the bulletin describes a number of pit and container arrangements underneath anthracite-burning heaters, the ash falling by gravity and collecting for periods up to a year without attention. Copies may be had by writing Anthracite Industries, Inc., Chrysler Building, New York City, asking for Bulletin MA-1.

Explosives, Mine Safety and Coal Treating Canvassed on Illinois Boat Trip

MEMBERS of the Illinois Mining Institute embarked on both the Mississippi River and a discussion of the proper use of permissible explosives, protection against oil-drilling operations, mine safety and dustless treatment of coal when the "Golden Eagle" packet left St. Louis, Mo., June 10, on the institute's 20th annual boat trip and summer meeting, which ended June 12.

H. H. Taylor, vice-president, Franklin County Coal Corporation, Inc., Chicago, and institute president, welcomed members and guests June 11 and then relinquished the gavel to Paul Weir, consulting engineer, Chicago, and Joseph E. Hitt, Walter Bledsoe & Co., St. Louis. Walter N. Polakov, United Mine Workers, Washington, D. C., was accorded the privilege of the floor during the sessions and described briefly some of the sins of the union in its study of mechanization and asked the cooperation of the operators in the development of a program.

Pointing out that permissible explosives date back only to 1907 in the United States, F. W. Roman, explosives engineer, Hercules Powder Co., Chicago, discussed some of the factors underlying their proper use. Safety was the major consideration in the initial investigation of the explosives problem, and if this consideration "was a prime one in the days of hand labor, how much greater it has become since mechanization! The whole process has been speeded up. Things have to be kept moving on the basis of the loading unit and there can be no delays. More dust is created by mechanical loading. All these factors make it more important than ever that proper explosives be used and that miners devote attention to loading and firing in accordance with good blasting practices and the Bureau of Mines conditions for permissibility.

"Coupled with these 'safety' considerations we have the matter of breaking up the coal in the most efficient manner for the loading machine. Hence, mechanical mining requires greater supervision over the use of explosives, together with a more careful distribution of the explosive itself. Supervision must start with the preparation of the working place." Square ribs in cutting are essential. Bugdust should be completely cleaned out of the kerf. Correct drillhole placement is another important item. "The general practice and a good starting point is to drill the rib holes about 18 in. from the ribs and parallel with the center line of the working place. . . . Care also should be taken in spacing the auxiliary holes so that correct equalization of burden will be maintained.

"The type of permissible to be used, together with its distribution, depends entirely upon the type of coal, height of seam and whether the coal has distinct faces and butts, sulphur or other impurities and any distinct bands. In a soft coal without impurities, 4 ft. or under, it is our experience that a bulky, slow-speed permissible is most effective. Where impurities are encountered, a medium-dense medium-speed explosive can be used. If in either case we have distinct faces and butts, a slow-speed permissible should be used. On the other hand, if it is an open coal, a permissible with a higher rate of detonation will perform its work before the gases can seep out through the openings. As we get into higher coals, with either embedded impurities or distinct bands, it generally is found necessary to go to permissibles with greater densities."

Air Spacing in Hole Is Useful

Every mine presents a different problem. However, one practice beneficial in many instances in Illinois is the use of air spacing in the hole, secured by: a dummy cartridge properly positioned with a string; loosely packed rock-dust dummies through part of the hole column; or a hole considerably larger than the cartridges. "Air spacing of any type appears to have the benefit of reducing the first shock created by the detonation of the permissible explosive, thus reducing the pulverizing effect." Finally, said Mr. Roman, operators must cooperate with explosives manufacturers to insure that permissibles are used in accordance with Bureau of Mines regulations.

In the ensuing discussion, H. A. Treadwell, general superintendent, Chicago, Wilmington & Franklin Coal Co., Benton, Ill., asked that operators examine their methods of shooting bottom, in particular to make sure that they in effect are not employing the "dobieing" methods said to have been responsible for the Red Jacket explosion. Cushion blasting, he declared, has shown that the coal is moved out from the face and left in better condition for mechanical loading.

Problems of deep cutting in thin coal (9 ft. in 5-ft. coal) were brought up by J. S. Anderson, superintendent, Saxton Coal Mining Co., Terre Haute, Ind., who stated that the concentration of explosives in the back of the hole, with consequent poorer results at the front, had been improved by using a small cartridge giving

Any Stickers Today?

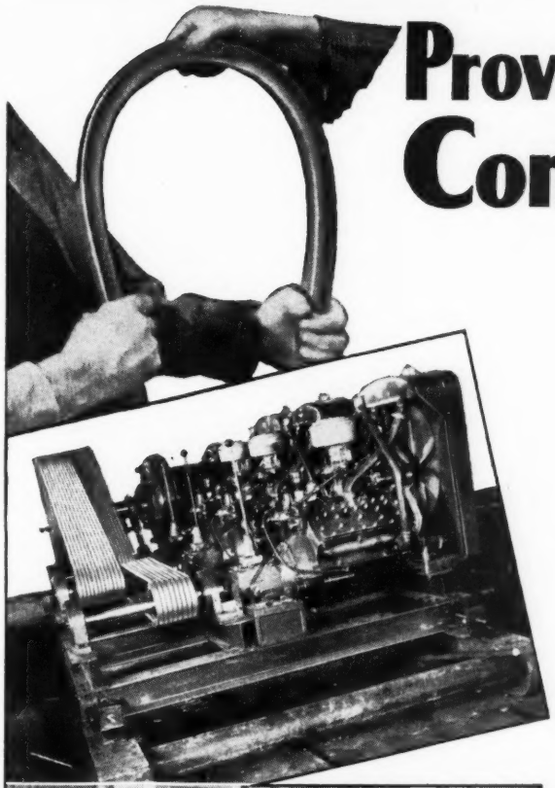
Do you have a shooting problem in connection with permissible explosives? Helpful hints on the use of these blasting mediums, including a recommendation that cushion shooting be investigated, were given by F. W. Roman at the summer meeting of the Illinois Mining Institute.

What can a mine operator do to protect his workings from oil-well-drilling operations? R. J. Oldham, among other things, recommends careful cementing.

Does your safety work click? If not, you may need to develop the cooperative spirit stressed by Joseph Firth, Jr.

Is your oil treatment of coal as effective as you would wish? Lee Hazen finds the heavier-bodied oils and wax more effective.

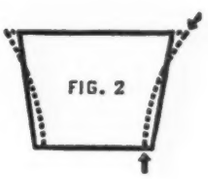
Feel THE Sidewalls of ANY V-BELT *AS IT BENDS*

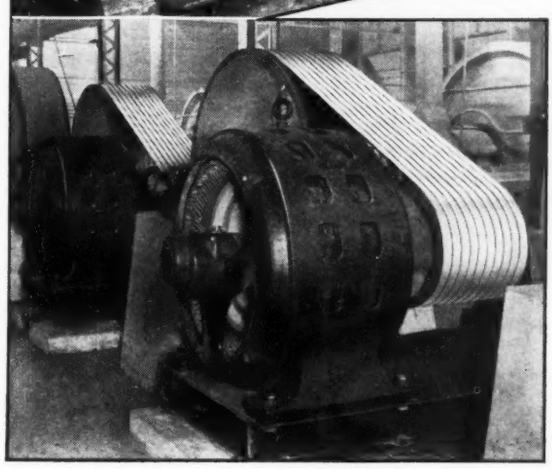


Prove for Yourself WHY the Concave Side SAVES MONEY

Feel the side-walls of *any* V-belt as it bends. You will feel its top narrow under tension, its bottom widen under compression. You will see that a *straight-sided* V-belt *must* assume in its sheave-groove the shape shown in figure 1, below. Note the out-bulge of the sides!

WHAT HAPPENS WHEN A V-BELT **BENDS**





Now try the same test with a Gates Vulco Rope. You will find that the *same shape change* merely *straightens* the precisely engineered concave side (see figure 2). There is no side-bulge. This insures uniform side-wall wear; *longer* life! Moreover, the full side-wall grip on the pulley naturally carries heavier loads without slipping—a saving in belts and also a saving in *power!*

The Gates Vulco Rope is the only V-Belt built with the patented concave side.

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air spacing in addition to stringing out the explosives column and bringing the breaking force closer to the front.

F. M. Schull, Binkley Mining Co., Terre Haute, reported on a thin seam from which a middle band was cut out to a depth of 6 ft. Eventually, the problem of shooting the two benches, each less than 18 in. thick, was solved by placing half a stick of explosive, with electric detonator, at the back of the hole, then tamping half the hole and placing another half stick, followed by tamping to the hole collar.

Under a somewhat similar condition in an Indiana mine, said Mr. Roman, rib holes to the back of the cut were employed, with short holes between the long holes to provide additional breaking force toward the front. The unbalancing of burdens in deep cuts, he stated, is being thoroughly investigated, although explosives manufacturers have not yet arrived at specific recommendations. Answering a query by D. W. Jones, superintendent, Princeton (Ind.) Mining Co., Mr. Roman stated that while foreign matter between cartridges might result in missed shots, such trouble ordinarily would not be encountered in the type of air spacing employed with cushioned blasting.

Oil Drilling Presents Problem

Declaring it to be only a matter of time until practically all Illinois operators are faced with the problem, and pointing to the State's strictly limited powers to date, R. J. Oldham, general manager, Centralia (Ill.) Coal Co., described measures taken in his district to safeguard mines in the drilling operations resulting from the current oil boom in the State. In active workings, or in inactive workings connected with operating mines, the problem is to prevent present or future entrance of fresh or salt water or gas.

Mr. Oldham recommended that operators insist on drillers putting down holes at least 2 in. larger than the string of casing to be placed in it to a solid stratum below the seam on which the casing can be grounded. This facilitates cementing both above and below the coal seam, which should be done as soon as the casing is grounded. Then, when the hole reaches the oil sand, drillers should be urged to use an oil casing 3 in. smaller than the outside casing, cementing around this line also as an additional protection against water and gas entering the mine. In any case, said Mr. Oldham, cement should be pumped down through the casing until it returns into the mine or to the surface, as the case may be, as in other methods of cementing are unreliable. In the initial cementing, 48 hours should be allowed for setting, even though quick-setting material is employed, with 72 hours in the final cementation of the oil line, according to Mr. Oldham.

These recommendations apply particularly to rotary drilling. In cable-tool drilling, oil men usually are forced to case and cement as an incident to drilling. Locating wells to pierce pillars usually can be accomplished if accurate maps are available. However, in town-lot drilling, room sometimes is not available for shifting the well location so that it will strike a pillar. Mr. Oldham strongly urged a study of the drilling question and also cooperation with State authorities so that proper drilling precautions could be assured and irresponsible drilling organizations curbed.

While the duties of the mine inspector largely are prescribed by law, said Joseph Firth, Jr., State mine inspector, Sixth district, Benld, Ill., "the present Department of Mines and Minerals believes that the inspectors should give full cooperation in the prevention of accidents where no semblance of a violation has occurred. . . . While I think every one is interested in promoting safety, there has been in some mines a lack of cooperation between employers and employees in preventing accidents. The inspector probably is the person who can correct this by persuasion of both parties that accidents are harmful and expensive to everyone. The things that harm property usually are the same things that harm men."

In nearly every case there is a reason for an accident, and the causes can be eliminated through careful supervision and the cooperation of the workers. First-aid training is a very helpful adjunct to safety, "and the most outstanding safety records established by mines in our State belong to organizations which have trained their men in first aid." Installation of safty devices and programs really is just the beginning of the work, "as there still would be accidents unless the workers and officials were made to think in terms of safe practice."

Regular meetings are an excellent way of arriving at a safety spirit. Training of men in the safe and proper way of doing their work is essential, and in this "the supervisor should not only know that way but should have it done that way. When the job is done the efficient way it will be the safest way." Ample supervision is necessary. Also, "I have found that where proper timbering systems are inforced and adequate face and roof inspections are made, fewer roof and face accidents occur."

Accidents are not always caused by bad mining conditions, Mr. Firth concluded. "Sometimes it seems almost the reverse. We also have found that there isn't just one major cause for injuries. Our investigations do indicate, however, that there is one essential element in the prevention of injuries: cooperation between employee and employer."

Mechanical Mining Safer

In response to a question by Dr. Polakov, Mr. Treadwell stated that injuries from falls of roof and face had been materially reduced by mechanical mining, a conclusion in which Mr. Firth concurred. Pursuing a topic introduced by Mr. Jones, Mr. Firth stated that when a standard timbering plan was adopted in one mine in his district, injuries were cut 50 per cent in much worse work. Mr. Schull gave Holmes chapters much credit for forwarding safety at mines of his company by bringing management and employees closer together. Formation of such chapters, Mr. Jones stated, results in men taking a personal interest and thus makes it unnecessary to rely on supervision alone.

Calcium chloride was the first commercial agent employed, said Lee Hazen, chief chemist, Bell & Zoller Coal & Mining Co., Zeigler, Ill., in discussing dustless treatment of coals. Oil also was first used at about the same time, but now "petroleum products have largely displaced calcium chloride." Low-viscosity oils and oil emulsions were mainly used in the beginning "because they were cheaper and equipment for spraying the heavier oils had not been developed.

"The first methods used for dustproofing coal were not satisfactory, although treated coal was, no doubt, much less dusty than untreated coal. The chief trouble, particularly with Illinois coals, was that the oil treatment was effective for only a short time." Bell & Zoller began study of the problem in 1936, at which time recommended oils did not have a viscosity exceeding 200 sec. and the "quantity recommended seldom exceeded 5 qt. per ton," probably on the basis of experience with Eastern coals.

At that time, 100- to 150-sec. oils were being used, and it was discovered that coal treated with these oils became dusty after four to six weeks, due, it was thought, to oil evaporation. Use of oils with decidedly different evaporation rates at elevated temperatures was tried, but no difference was observed at ordinary temperatures. Some 200-sec. oil was sprayed on partially air-dried buckwheat, which was sealed in glass jars. Results were: 1.5 gal. per ton, dust appeared and oiled appearance disappeared in less than one week; 3 gal., some dust in eight weeks, quite dusty in twenty weeks; 4.5 and 6 gal., no dust or loss of oiled appearance.

"Apparently, the coal became dusty due to absorption and not because the oil evaporated." Later experiments with a dusting cabinet similar to the Koppers cabinet showed, in the case of an arbitrary mixture of partially air-dried coal (40 per

Kennedy Voices Opposition To 30-Hour Week

Coal operators of the United States opposed any proposal to inaugurate a six-hour day or 30-hour week, D. C. Kennedy, chairman of the Appalachian Joint Wage Conference and secretary of the Kanawha Coal Operators' Association, declared at the international coal conference held early in May in connection with the International Labor Organization, at Geneva, Switzerland, where he represented American producers. Commenting on wage agreements in this country, he said: "Since 1932 the wages of miners have increased more than 100 per cent and their hours have been reduced from eight to seven per day and to five days per week. These increased costs have had an effect of slowing down the industry, on account of substitute fuels such as oil, gas and electricity taking a considerable part of the business. These increases also have been responsible for a large number of coal companies mechanizing their mines with labor-saving machines."

"To require that the coal industry should employ a larger number of employees than necessary by reducing the hours of work," he said, "would place the industry in a position that is uneconomic and unsound and would give substitute fuels further impetus that would be disastrous not only to the employer but the employee as well."

cent ¾x5/16 in., 50 per cent 5/16 in. x 10 mesh and 8 per cent minus 10 mesh), that a 350-sec. oil was several times more effective than either 100- or 200-sec. oil when 8 qt. was applied per ton. With 5 qt., the variation in effectiveness was not so pronounced.

"Other experiments have been made which show that wet coal is more difficult to dustproof than dry coal. An average of twelve tests showed that the treatment was 92 per cent effective on dry coal and 81 per cent on wet coal, using 7 qt. per ton. Wax has been used for treating domestic-stoker coal for the past year with very satisfactory results. . . . Tests to determine the amount of dust have shown a high per cent of effectiveness even after long storage periods."

Concurrence in Mr. Hazen's views on 350-sec. oil was expressed by Fred Miller, assistant to the vice-president, Franklin County Coal Corporation, Inc., Herrin, Ill., who declared it to be the most satisfactory used to date. Mr. Treadwell, also using 350-sec. oil, stated that reports from the East indicated a trend to even as high as a 600-sec. oil. Better results from the heavier-bodied oil in Illinois were due to the porous nature of the coal, making absorption of the lighter oil more rapid.

Although great care has been taken to reduce dust by other methods, said Mr. Taylor, it still is necessary to oil, which has been found a real advantage in moving coal. Messrs. Hazen and Miller, responding to a question by Mr. Hitt, stated that treating sizes larger than stoker was not as effective, due to subsequent breakage, but still was an advantage. W. S. Stinton, Socony-Vacuum Oil Co., Inc., St. Louis, stated that treating oil derived from a cut-back fuel oil apparently was slightly less effective than a lube-oil-base fluid, as the fuel oil is more easily absorbed. Experiments to date indicate better protection with heavier-bodied oils up to a certain point. Heavier oils also seem to give a certain measure of protection against freezing, although this was disputed by Mr. Hitt.

Limited experiments at a West Virginia operation, said John Griffen, Koppers-Rheolaveur Co., Pittsburgh, Pa., seem to indicate that oiling coal prior to washing may result in the lower moisture in the washed product. Little change in washing characteristics should occur, except possibly in the very fine sizes, with selective wetting of coal and impurities as another factor.

A new method of protecting trackless openings in mines by the use of rock dust in the original paper sacks was announced by John E. Jones, safety engineer, Old Ben Coal Corporation, West Frankfort, Ill., at the conclusion of the technical sessions. No details were given. Mr. Jones stating that as a result of Bureau of Mines tests seven conclusions had been accepted and an eighth with reservations. An Information Circular is being prepared.

Industrial Notes

Harvey B. Mann, long identified with DeLaval and Cochrane sales, has established an office under the name MANN ENGINEERING CO. at 429 Penn Ave., Pittsburgh, Pa., to represent: Fischer & Porter Co., rotameters; Fuller Co., rotary compressors and vacuum pumps; Richardson Scale Co., automatic coal scales; Springfield Boiler Co., water-tube boilers; Sterling Engine Co., gasoline, gas and diesel engines; Bin Dicator Co., bin-level indicator switches.

MANHATTAN RUBBER MFG. DIVISION of Raybestos-Manhattan, Inc., has appointed J. B. Wittrup manager of its Chicago mechanical rubber branch.

SHELL UNION OIL CORPORATION has appointed Harold L. Curtis as sales promotion and advertising manager, vice Fred C. Koy, resigned to become vice-president in charge of Eastern sales for Wilding Picture Productions, Inc. Harry J. Underwood, formerly division manager at Philadelphia, Pa., replaces Mr. Curtis as manager of the Metropolitan division.

BUCYRUS-ERIE CO. has appointed the Bode-Finn Equipment Co., Inc., Cincinnati, as distributor of its products in southern Ohio.

CRANE CO. has appointed L. B. Hampton as manager of its Pacific Northwest division, vice F. A. Nitchy, who is retiring after 46 years' service with the company.

CLEVELAND WORM & GEAR CO. and its affiliate, the FARVAL CORPORATION, have named A. J. Jennings as general sales manager. He has been directing Farval sales for many years.

LINK-BELT CO. announces that J. Pierre Vogel has joined its engineering sales organization, with headquarters in Pittsburgh, Pa., where he will specialize on the application of bituminous-coal-preparation equipment, including tipples, washeries, and other materials handling problems.

AMERICAN CONCRETE & STEEL PIPE CO. has granted the exclusive sale of Amercoat products to the Amercoal Sales Agency, Huntington Park, Calif., organized by and to be managed by Miles C. Smith, formerly sales manager of the Amercoat division of the American Concrete & Steel Pipe Co.

STEARNS MAGNETIC MFG. CO. has appointed the Delavan Engineering Co. as its sales representative in Des Moines, Iowa. The latter company was recently organized by N. B. Delavan, formerly sales manager and later vice-president and director of sales of the Penn Electric Switch Co., and two associates in that company, R. Douglas Marshall and Randall A. Smith.

Coal-Mine Fatality Rate Registers Advance

Accidents at coal mines of the United States caused the deaths of 92 bituminous and 24 anthracite miners in April last, according to reports furnished the U. S. Bureau of Mines by State mine inspectors. With a production totaling 22,195,000 tons, the death rate among bituminous miners was 4.15 per million tons, compared with 2.69 in the corresponding month of last year.

The anthracite fatality rate in April last was 7.72, based on an output of 3,108,000 tons, as against 4.81 in April a year ago.

For the two industries combined, the death rate in April last was 4.58, compared with 3.13 in April, 1937.

Fatalities during April last, by causes and States, as well as comparable rates for the first four months of 1937 and 1938, by causes, are given in the accompanying tables.

FATALITIES AND DEATH RATES AT UNITED STATES COAL MINES, BY CAUSES*

January–April, 1937 and 1938

Cause	Bituminous: Number Killed		Bituminous: Killed per Million Tons		Anthracite: Number Killed		Anthracite: Killed per Million Tons		Total: Number Killed		Total: Killed per Million Tons	
	1937	1938	1937	1938	1937	1938	1937	1938	1937	1938	1937	1938
Falls of roof and coal	205	143	1.273	1.334	46	58	2.390	3.747	251	201	1.392	1.638
Haulage	81	49	.503	.457	12	9	.624	.582	93	58	.516	.473
Gas or dust explosions:												
Local	3	9	.019	.084	..	1	....	.065	3	10	.016	.082
Major	27	60	.168	.559	..	8	....	.517	27	68	.150	.554
Explosives	11	4	.068	.037	8	4	.416	.258	19	8	.105	.065
Electricity	16	10	.099	.093	1	..	.052	....	17	10	.094	.082
Machinery	11	9	.068	.084	1	..	.052	....	12	9	.067	.073
Shaft	10	2	.062	.019	2	1	.104	.065	12	3	.067	.024
Miscellaneous	9	3	.056	.028	8	3	.416	.194	17	6	.094	.049
Stripping or open-cut	10	1	.062	.009	4	8	.208	.517	14	9	.078	.073
Surface	25	14	.155	.131	6	2	.312	.129	31	16	.172	.130
Total	408	304	2.533	2.835	88	94	4.574	6.074	496	398	2.751	3.243

* All figures subject to revision.

COAL-MINE FATALITIES IN APRIL, 1938, BY CAUSES AND STATES

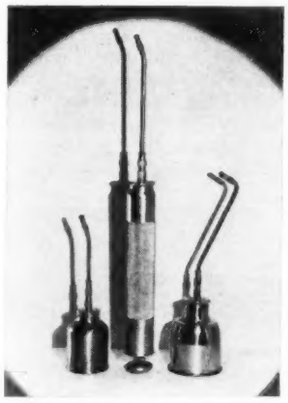
State	Underground: Falls of roof	Falls of face	Haulage	Gas or dust explosions	Explosives	Electricity	Other machinery	Total underground	Shaft: Persons fall'ing down shafts	Open-Cut and Surface: Mine cars	Railway cars	Falls of persons	Machinery	Other causes	Total surface	Grand total
Alabama	..	..	..	....	..	1	....	1	....	..	..	..	..	..	..	1
Colorado	..	..	1	....	..	..	....	1	....	..	..	..	..	..	..	1
Illinois	..	..	1	....	..	..	....	1	....	..	1	..	1	..	2	3
Indiana	..	..	1	....	1	..	....	2	....	..	..	..	..	..	..	2
Kentucky	2	..	..	....	..	..	1	3	....	..	..	..	..	..	..	3
Maryland	..	..	..	....	..	..	1	1	....	..	..	..	..	..	..	1
Missouri	1	..	..	....	..	..	....	1	....	..	..	..	..	..	..	1
Ohio	4	..	2	....	..	..	....	6	....	..	..	1	..	..	1	7
Pennsylvania (bit.)	4	..	1	....	..	..	....	5	....	..	1	..	..	..	1	6
Tennessee	1	..	..	....	..	..	....	1	....	..	..	..	..	..	..	1
Virginia	1	..	..	45	..	..	....	46	....	..	..	..	..	..	..	46
West Virginia	10	..	3	4	1	1	....	19	....	..	..	..	..	1	1	20
Total bituminous	23	..	9	49	2	2	2	87	....	..	2	1	1	1	5	92
Pennsylvania anthracite	9	4	..	8	1	..	....	22	1	1	..	..	..	..	1	24
Total	32	4	9	57	3	2	2	109	1	1	2	1	1	1	6	116

WHAT'S NEW

In Coal-Mining Equipment

LUBRICATOR

For lubricating bearings, gears and other moving parts where oil is requirel, American Chain & Cable Co,. York, Pa., offers the Acco-Morrow pressure lubricator for applying lubrication at pressures up to 1,000 lb. per square inch. Such



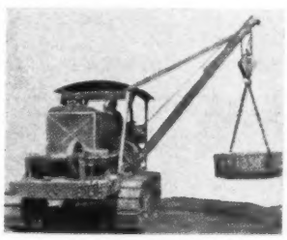
pressure lubrication, it is pointed out, flushes out grit and dirt and at the same time forces oil into the bearing. An outstanding feature of the new lubricator is the "Oilingseal" tip of compressible composition. This tip makes a pressure-tight contact with the top edge of any common oil hole and practically all sizes and types of cups and oil-hole covers in common use. No special fittings are needed, it is stated, and oil is applied by slowly pushing the plunger. Four gun-type units operating at 1,000 and six others at 500 lb. per square inch are available.

CLARIFIER

Graver Tank & Mfg. Co., East Chicago, Ill., offers the new Seip multi-tray clarifier characterized by upward sludge filtration by means of a periphery intake channel, said to give a ten-times-larger intake. The clarifier consists of as many as seven round, inverted trays supported by brackets attached to the inner side of the round tank shell. The space within each tray forms a settling chamber. Solids are said to settle on the top of each tray (which acts as a bottom for the settling chamber above it) and function as an entangling medium for lightweight particles which otherwise would not settle quickly. Immediately above each tray is a set of movable scrapers adjustable in speed to carry away the surplus sludge. A liquid draw-off is provided in the top of each chamber as far as possible from the intake to lengthen settling time.

CRAWLER HOIST

Harnischfeger Corporation, Milwaukee, Wis., offers the P&H multi-service crawler hoist, said to incorporate three hoist drums in one machine to provide unusually high lifting capacity with the drawbar pull and mobility of a tractor. Lifting capacity with a stiff leg is 35,000 lb. Forward speeds (three) range from 1.3 to 5.2 m.p.h. Some of the tasks for which the unit is designed are: pushing a snowplow, bulldozer or angle blade; lifting as a crawler crane or clamshell; pulling rotary scrapers, dump wagons, road graders, etc.; pipe handling and backfilling of trenches; drilling with a boring head at any angle up to 45 deg. in any direction;

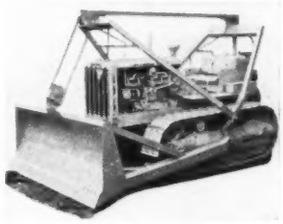


switching freight cars; hoisting platform elevators in construction; general utility work in steel erection; and powering flat-line cableways or drag scrapers, etc.

Harnischfeger also announces the new P&H Model 255 ¾-cu.yd. high-speed excavator, stated to be convertible to seven types of service. Features cited by the company include "high-leverage" drive, rolled-alloy-steel construction and welding throughout. Hoist and digging drums are ample in size to accommodate without overlapping the cable required for operating a 40-ft. boom.

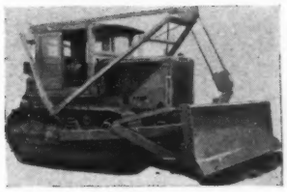
BULLDOZER—ANGLEDOZER

The Type C "Bulldozer" and the Type C "Angledozer" are new products offered by R. G. LeTourneau, Inc., Peoria, Ill. Designed for use on "Caterpillar" D4, D6 and D7 tractors, both units utilize a bowl-and-



yoke structure similar to the current "Track Type," but the bowl is supported by an overhead A-frame rather than by two side arms. This central mounting distributes the weight more uniformly over the tractor tracks. Cable life also is lengthened, the manufacturer asserts, because of fewer sheaves more simply arranged. The "Angledozer" embodies the quick-change angling and bowl-tilting adjustments of former models for sidecasting right or left up to 30 deg. or for lowering either corner of the blade. Both units are operated from a power-control unit mounted on the tractor.

LeTourneau also offers a new double-drum power-control unit for heavy cable-controlled grading equipment, which it states has been designed for extreme strength and foolproof, efficient operation. Designated as the Model R8 for use on "Caterpillar" D8 tractors, changes in the new unit, as compared with the previous



Type N unit, include: lower line speed, line pull (empty drum) increased to 9,600 lb.; increase in capacity of each drum to 255 ft. of ½-in. 6x19 rope; and a 40-per cent increase in brake area.

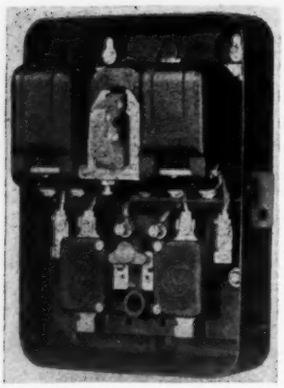
TRACKLAYING TRACTOR

Marmon-Herrington Co., Inc., Indianapolis, Ind., has announced a new tracklaying tractor which it describes as having top speeds of 30.5 to 32.2 m.p.h. in gasoline models and 20.75 to 23.9 in diesel models, in addition to ease of handling, high pulling power, quiet operation and economical performance. The tractor is made with a special rubber track said to outwear the conventional metal track five times. This track, it is stated, will not stretch while providing a tractive effort within the ability of the machine. A watertight hull permits fording of streams of considerable depth. Three sizes are available in both the gasoline and diesel lines.

STARTERS—RELAYS

Clark Controller Co., Cleveland, Ohio, offers the new Bulletin 6013 switches for starting squirrel-cage induction motors by connecting them directly to the line. These starters also may be used as primary switches for wound-rotor motors. Features cited by the company include: across-the-line starting, non-reversing operation, overload protection, no-voltage protection or release, cadmium-plated parts, molded-asbestos arc shields, ample wiring space, heavy-duty magnet-operated contactors, self-cleaning wiping contacts and inclosed construction.

Seven sizes are available in the following forms: M, remote operation only; MA, overload reset pushbutton in the cover (separate pilot device required); MB, "Manual-Off-Automatic" switch and reset pushbutton in cover (used with separate two-wire pilot devices); MC, "Start-Stop" pushbutton station in cover, with provision also made for externally resetting the overload device on three sizes (this form eliminates the need for separate pilot devices, although they may be used if desired).



Width, height and thickness of the first five sizes range from 7¼, 10⅞ and 4½ in. to 23½, 28¼ and 14½ in. No-voltage protection is provided when a three-wire pilot device is used and no-voltage release with a two-wire pilot.

Another new product of the company is the Bulletin 7322 thermal overload relay, shown below a Bulletin 6013 starter in the accompanying illustration. Used as an auxiliary device to open the pilot circuit of a magnetic starter or controller for an a.c. motor, the relay is said to have the following features: accurate inverse time protection with delayed trip to permit high starting-inrush currents; heaters designed to meet Underwriters' Laboratory requirements; inclosed thermal mechanism to eliminate effect of stray air currents; design to permit many operations without deterioration of thermal mechanism; large electrical clearances; double-break high-contact-pressure silver-to-silver contacts; manual reset by readily accessible button; built-in start-stop button available; standard front connections, with back connections available.

Type RD heavy-duty master switches for mill and crane service (frequent operation with minimum maintenance) are another Clark offering. These switches are available in one to six points, reversing and non-reversing.

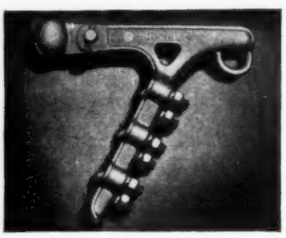
BONDS—CLAMPS

Ohio Brass Co., Mansfield, Ohio, offers the "O-B Temporary Mine Setscrew Bond," designed for room work where frequent installation and reclamation is the rule. The bond is provided with terminals which embrace the rail. A quick turn of the heavy setscrew locks the terminals to the rail mechanically and electrically. A 2/0 copper strand joins the terminals.

To meet the demand for a small suspension clamp with high slip strength, Ohio Brass has developed a clamp with a cable-seat diameter of 0.46 in., using U-bolts to hold the conductor against the clamp seat.

Formerly, this size was available only with J-bolts. With the new addition, all thirteen sizes of O-B suspension clamps are offered with either J- or U-bolts. Light weight, gradual approach and extreme flexibility are claimed for these units.

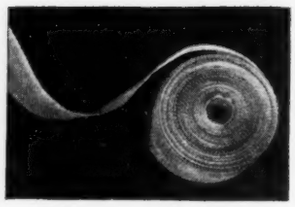
Ohio Brass also announces that it has added a loop under the nose of its small "Hi-Lite" strain clamp, making it possible



to attach the blocks for securing proper conductor tension directly in the clamp, thus simplifying dead-ending small conductors. The "Hi-Lite" with this feature accommodates, unlined, 0.35- to 0.55-in. conductors and, lined, 0.30- to 0.45-in. conductors.

GLASS TAPES

Corning Glass Works, Corning, N. Y., offers new tapes woven entirely from Corning glass yarns for the insulation of motors, generators, transformers, cables and other electrical conductors. These tapes are stated to be particularly valuable for application where temperature resistance, permanence, strength and moisture-resistance are important. They are said to impregnate readily with resins, varnishes and gums to form an insulation



with a high dielectric strength in addition to resistance to moisture. Tapes are available in thicknesses of 0.010, 0.015 and 0.020 in., and in standard widths from ¼ to 1¼ in.

BELTS—HOSE

An oilproof conveyor belt for use where dustless treating of coal with oil is the practice is offered by the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J. Bearing the designation "Paranite-G.O.P. (Gas-Oil-Proof)," the new belts are stated to contain no natural rubber and to be unaffected by oil. The material used covers both sides of the belt and also is said to be abrasion-resistant. Belts are available in regular widths, plies and covers.

Oilproof transmission belting bearing the same designation also is available in this same material in the regular belting sizes. "Gas-Oil-Proof" synthetic-rubber-lined air-drill hose, bearing the designation "Grenadier G.O.P.," also has been announced by Manhattan to overcome the disadvantages resulting from the entrance of oil into air hose. Grenadier hose is available in sizes from ¼ to to 2 in.

LIGHT-ALLOY SHOVELS

New light-weight shovels and scoops with blades made of a specially treated aluminum alloy are offered by the Wood Shovel & Tool Co., Piqua, Ohio. Weight is cut in half, eliminating 3 to 5 lb. of heft, according to the company, which also points to resistance to acid and corrosion and non-sparking characteristics. Special blade treatment is said to assure long life. Seven different models in various sizes are available.

COUPLING

Link-Belt Co., Chicago, offers the new "RCB" flexible coupling consisting of two cut-tooth sprockets connected by a piece of specially constructed single-width finished steel roller chain. It uses a recently patented divided-roller feature said to combine the advantage of double roller chain with the stronger and simpler construction of single-width chain. The divided roller provides independent roller action for each sprocket, and as the contact between roller and sprocket causes the roller to revolve on its bushing, the tendency to scuff roller and sprocket teeth is avoided. Longer coupling life and extension of the range of efficient application are claimed for the new couplings, in addition to other improvements.

RESPIRATOR

Development of a new type of respirator which will prevent silicosis if worn faithfully is announced by the American Optical Co., Southbridge, Mass. Designed for maximum comfort, the respirator is approved by the Bureau of Mines for Type

A dusts. Features reported by the maker are: compactness, light weight, unobstructed vision, no facial adjustment required, improved valves to ease breathing, ease of maintenance and 42 sq.in. of filter area.

BELT HOOKS

Armstrong-Bray & Co., Chicago, announces a new method of carding "Wiregrip" belt hooks which it asserts keeps each hook in exact position, speeds the loading of lacing machines, assures perfect alignment and prevents the usual waste of short ends cut from cards of hooks. With this system of carding, the desired number of hooks can be cut off easily with a pocket knife or scissors. No special tool is required and the hooks are held so securely, it is stated, that they will retain their perfect alignment indefinitely even under very rough handling.

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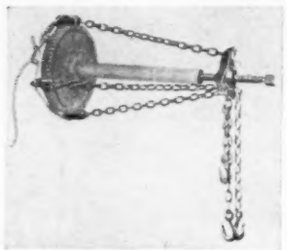
GEAR PULLER

A new gear and wheel puller has been placed on the market by the Edelblute Mfg. Co., Reynoldsville, Pa. It consists of three double-end chains having a grab hook on one end for attaching the puller to spoked wheels and a special close-grip hook on the other end for engaging solid gears. The chains fit into the forks of a three-armed yoke, through which a screw bar is threaded.



The point of the bar fits against the end of the shaft and pulling is accomplished by applying a wrench on the square end of the screw bar.

Due to its flexible design, this puller can be used on spoked, solid, webbed or any other type of gear or wheel in any size either close to the end of the shaft or far away, according to the manufacturer. One size of puller handles most of the every-day pulling jobs. Two sizes of "Anchor" gear and wheel puller are made, however, with capacities of 4 and 12 tons.

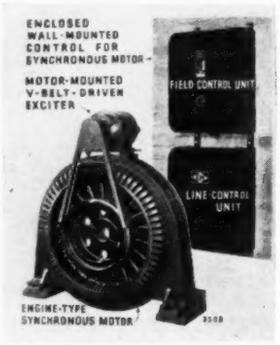
CAR PULLERS

Fridy Hoist & Machinery Co., Mountville, Pa., offers improved inclosed vertical-capstan car pullers in two sizes. The "Junior" size, in 7½- and 10-hp. ratings, is designed for handling railroad cars with a total weight of 150 and 250 tons on slight grades at slow rope pull. Both ratings are furnished with oversize vertical capstans 10 in. in diameter with 13-in. faces. All operating parts, according to the company, are inclosed in a cast-iron housing for safety and weather protection.

The "Heavy-Duty" pullers are available in ratings of 15 and 20 hp. for handling 350 to 500 tons on slight grades at slow rope pull. Capstans are 12 in. in diameter and have 13-in. faces, said to be of great advantage in eliminating slippage of the manila rope when handling heavy loads. These pullers also are inclosed in a cast-iron housing.

COMPRESSOR DRIVE

To make direct-connected synchronous motors more practical and advantageous for smaller compressors requiring down to 40 hp., Electric Machinery Mfg. Co., Minneapolis, Minn., has developed a new drive unit featured by an exciter mounted on top of the motor and driven from a sheave on the rotor by a V-belt, and an automatic inclosed wall-mounted control instead of the usual panel-mounted starter. Advantages of the new drive are stated to be lower first cost, simpler installation and smaller floor space. The line-control



unit is of the magnetic full-voltage type with overload and under-voltage protection. The field control unit is of the slip-frequency responsive type for automatically applying and removing field-motor excitation.

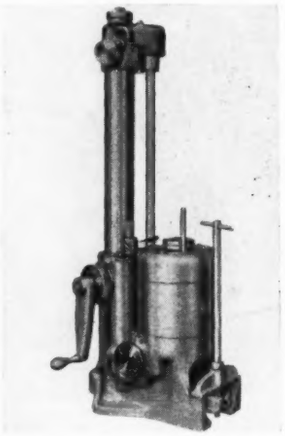
CURTAIN WALL

A new type of insulated industrial curtain wall for steel-frame buildings is announced by Johns-Manville, New York. The walls consist of incased insulating board (1 in. of board with a ½-in. veneer of asbestos "Flexboard" or flat "Transite") over which is applied a wall of corrugated "Transite." Between the windows the wall is constructed of incased insulating board to which is cemented a ¾-in. sheet of flat "Transite" to form the exterior surface.

Units are ready to be erected when they arrive on the job, according to the company, and provide walls that not only are fireproof but also are capable of withstanding high temperatures without melting, cracking or buckling. No special tools are required, as the material may be sawed, drilled and fitted with the ordinary carpenter's tools. Units of incased insulating board are held against the steel framework of the building by cadmium-plated bolts; gray caulking compound is applied to the edge of each sheet. As the thermal expansion is approximately the same as steel, no expansion joints are necessary.

BORING BAR

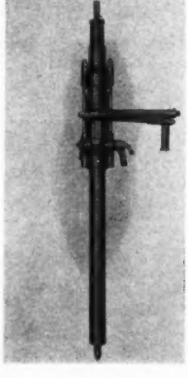
Described as the fastest, most powerful and most accurate unit yet designed, the new "Per-Fect-O" No. 777 boring bar is offered by the Van Norman Machine Tool Co., Springfield,



Mass. A complete unit powered by a ½-hp. capacitor motor, the bar will bore or sleeve any diameter from 2.600 to 5.343 in. Two feeds and two speeds are provided, and the unit, according to the company, takes a 0.050-in. cut at any diameter within its capacity.

STOPER

Ingersoll-Rand Co., Phillipsburg, N. J., offers the new "SA-90" hand-rotated "Stopehamer." The piston is said to combine the long wear of the "Jackhamer" piston with the resistance to breakage of the so-called "block" piston. The throttle valve consists of two circular plates held together



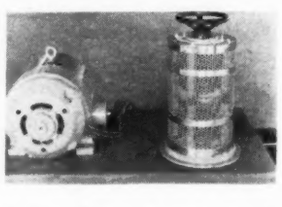
by air pressure, thus giving the advantages of the taper-type throttle with the ease of operation of the straight throttle. Fronthead is of the shrouded type overlapping the cylinder and increasing drill rigidity. The entire front end of the drill is equipped with easily renewable bushings. A new double-opening direct-flow main valve is claimed to result in low air consumption and high drilling speed.

PROTECTIVE PAINTS

Sherwin-Williams Co., Cleveland, Ohio, announces a new line of protective coatings, including S-W "Kem-Kromik" metal primer, "Kem-Elastic" metal-protective paints and "Kem" red lead (primer). The distinguishing feature of each of these products, according to the company, is the use of synthetic S-W "Kem Liquid," said to result, in the case of the paints, in the following advantages: more complete exclusion of water and gases from the metal protected; definitely greater durability; an improved appearance which is maintained in service; and easier application.

ADJUSTABLE-SPEED MOTOR

Crocker-Wheeler Electric Mfg. Co., Ampere, N. J., offers a "perfected and practical a.c. adjustable-speed shunt motor." So far, the new "Polyspeed" motor is available in sizes up to 7½ hp. It has a stator core and winding similar to an ordinary induction motor and a single-rotor winding similar to



the armature of a d.c. motor. It has 50 per cent more brushes than a d.c. machine of the same number of poles. Brush position is fixed. The speed regulator, which is separate, is of the induction type with no switch contacts to wear out or burn and consequently, according to the company, is well adapted to remote control. The "Polyspeed" motor, it is stated, provides an infinite number of speeds and not a series of steps. "It can be operated at any speed desired from slightly above standstill to 1,800 r.p.m. simply by turning the rotor of the speed regulator through an angle of 180 deg."